



Environmental Impact Statement

Anna Bay Sand Extraction & Site Office and Associated Manager's Residence

4226 Nelson Bay Road, Anna Bay

Prepared for

Hay Enterprises (NSW) Pty. Ltd.



DEVELOPMENT CONSULTANTS IN ENGINEERING, SURVEYING, PLANNING & ENVIRONMENTAL



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Environmental Impact Statement (EIS) prepared as per the requirements of the *Environmental Planning and Assessment Act 1979*, Section 4.12 (8) and associated regulation

Prepared By

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Development Application

Applicant Name: Tattersall Lander Pty Ltd
Proponent: Hay Enterprises (NSW) Pty. Ltd.
Subject Site: 4226 Nelson Bay Road, Anna Bay, NSW 2316
Lot 591 in DP 1191380
Description: Sand extraction and removal of up to 50,000 cubic metres of sand per annum for up to 30 years. Construction of an ancillary site office and associated manager's residence.

This Environmental Impact Statement addresses the matters as specified in Schedule 2 of the *Environmental Planning and Assessment Regulation, 2000*.

Certification

I certify that I have prepared this Environmental impact Statement, and that to the best of my knowledge:

- ✓ The statement has been prepared in accordance with Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*;
- ✓ The statement contains all the required relevant information to allow for a complete, accurate, and fair assessment of the proposal as relevant to this application;
- ✓ The information contained in this statement is neither false nor misleading.

Signature:



Name: Julie Wells

Date: 30 September, 2019

EXECUTIVE SUMMARY

Project Description

Hay Enterprises (NSW) Pty. Ltd. proposes to establish a sand extraction facility on Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay. The construction of an ancillary Site Office and Manager's Residence is also proposed at the site.

The proposed operations seek to remove wind deposited sand to natural ground level within an existing 33kV electrical easement and land immediately south of this easement. The proposal seeks to extract and remove up to 50,000 cubic metres (maximum) of sand per year over a 30-year period.

The proposed sand extraction facility will provide a sand resource suitable for general purposes in the construction industry. Importantly, removal of windblown sand will also ensure that the 33KV electricity easement within the site is kept clear of sand and can be accessed for maintenance purposes.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

The sand resource is intended for general construction and bulk land filling purposes in various locations; primarily Newcastle and the Hunter Valley. The product will be classified as VENM (Virgin Excavated Natural Material). Sand will be loaded via a front-end loader into haulage trucks and removed from the site to market destinations via Nelson Bay Road.

The proposed development is intended to operate between the hours of 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays. No operations are to occur on Sundays or public holidays.

There will be a maximum of 40 truck movements into and out of the site per day.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the EIS has been prepared having regard to the impacts created at that level.

Existing Site and Land Uses

The legal description of the site is Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay. The land is 13.12 hectares in size.

The land is currently owned by Ragusa Pty. Ltd.

The property is largely rural in nature. An existing dwelling and shed are located on the site.

The site has direct access to Nelson Bay Road.

The electrical easement is situated towards the south of the site.

Integrated Development

The proposed development is integrated development pursuant to section 4.46 of the *Environmental Planning & Assessment Act 1979*: the development constitutes a scheduled activity (extractive industry) pursuant to the *Protection of the Environment Operations Act 1997* requiring an Environment Protection Licence (EPL) pursuant to sections 43(b), 48 and 55.

Environmental Planning Instruments and Policies

The proposal has been assessed against relevant Environmental Planning Instruments and it is considered that the proposed development is consistent with their objectives and general requirements.

Key Issues

Key issues have been identified in the Secretary's Environmental Assessment Requirements (SEARs) and include the following:

- Water: impacts and project requirements
- Noise impacts
- Air quality impacts
- Biodiversity impacts
- Aboriginal cultural heritage considerations and impacts
- Historic heritage impacts
- Traffic and transport: project requirements and impacts

- Land resources impacts
- Waste: project considerations and impacts
- Hazards, including bushfire
- Visual impacts
- Social and economic considerations
- Rehabilitation considerations

Water Considerations: Impacts and Requirements

An expert Geotechnical and Groundwater Report was commissioned for the proposed development and was prepared by RCA Australia (2018) (see **Appendix A**).

Ground level at the electricity easement is 9m AHD.

The proposed sand extraction seeks to remove wind deposited sand at or above ground level. The construction of the proposed Site Office and Manager's Residence will also occur at ground level.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. Groundwater was encountered at a depth of approximately 2m AHD. Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand extraction during wet climatic periods.

The proposal development will not directly impact groundwater.

The proposed sand extraction and removal operations do not require connection to a water supply. The Site Office and Manager's Residence will utilise rainwater collected in rainwater tanks for any water supply requirements.

Noise Impacts

An expert Acoustic Impact Assessment was commissioned for the proposed development and was prepared by Advitech Environmental (2018) (see **Appendix B**).

Noise assessment criteria were established for adjacent sensitive receiving noise environments. Report noise predictions indicate that exceedances of the noise goals may be expected under some construction and operational conditions.

During construction, exceedance of the Noise Management Level (NMLs) at up to five residential receivers and one place of worship may be expected during internal haul road widening works and the works to improve the site access. It is expected that there would not be any exceedance of the high affected NMLs during any of the construction activities. Noise impacts would be minimised during the construction phase of the proposal by implementing the universal work practices provided within the specialist report.

During operation, marginal exceedances of the Project Specific Noise Level (PSNL) at up to three residential receivers and one place of worship may be expected during general sand extraction and removal operations and during vegetation mulching activities. In addition to universal work practices to minimise the site generated noise, additional recommendations are provided in the expert report to satisfactorily minimise noise emissions during the operational phase of the proposal.

It is anticipated that the maximum traffic volumes generated by the proposed development would be less than 0.5% of AADT, therefore, it is considered that no significant increase of road traffic noise is expected on Nelson Bay Road as a result of the proposal.

Air Quality Impacts

An expert Air Quality Impact Assessment was commissioned for the proposed development and was prepared by Advitech Environmental (2018) (see **Appendix C**).

The specialist report indicates that at maximum operation (50,000 cubic metres of sand per year) the proposed development will result in incremental increases in particulate matter and dust deposition at surrounding sensitive receivers.

CALPUFF dispersion modelling indicates that the proposed sand extraction and removal operations will be below the NSW EPA impact assessment criteria for Total Suspended Particles (TSP) and Particulate Matter (PM₁₀ and PM_{2.5}) as a result of cumulative impacts. Any exceedances that may occur will be likely attributed to elevated background concentrations rather than a significant incremental contribution from the proposed development.

It is predicted that there will be an exceedance of the maximum dust deposition impact assessment criteria at one receiver under adverse conditions, however, it is concluded that this is unlikely to occur during normal operations.

Biodiversity Impacts

An expert Biodiversity Development Assessment Report (BDAR) was commissioned for the proposed development and was prepared by Wildthing Environmental Consultants (2018) (see **Appendix D**).

Biodiversity impacts associated with the proposed development have been assessed through:

- Comprehensive mapping and assessment completed in accordance with adopted Biodiversity Assessment Methodology
- The identification of a threatened species of flora within the development site, the impacts to which have been adequately assessed
- Mitigation measures which have been outlined to reduce the impacts to biodiversity
- The generation of 19 Ecosystem Credits within the development site for impacts to native vegetation and the generation of 14 Species Credits for impacts to the Rough Doubletail Orchid.

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by either:

- (a) retiring credits under the Biodiversity Offsets Scheme
- (b) making payments into the Biodiversity Conservation Fund
- (c) funding a biodiversity action.

Based on the site ecological assessment, the mitigation measures proposed, and the retirement of the biodiversity credits, the proposal is considered acceptable from an ecological perspective.

Aboriginal Cultural Heritage Considerations and Impacts

An expert Aboriginal Cultural Heritage Assessment was commissioned for the proposed development and was prepared by Niche Environment and Heritage (2019) (see **Appendix E**).

The assessment included background archaeological and historical investigation, ongoing consultation with Registered Aboriginal Parties (RAPs) and an archaeological survey that included representatives from Mur-rooma Incorporated, Worimi Traditional Owners Indigenous Corporation, Karuah Indigenous Corporation, Worimi Local Aboriginal Land Council, and Nur-Run-Gee Pty Ltd.

During the survey, it was determined that the southern section of the land contained an area of high sensitivity within a sand dune system, which may be a continuation of a previously recorded Aboriginal cultural heritage site, AHIMS ID#38-5-032. The area of sensitivity was named Anna Bay PAD-1 (AHIMS ID#38-5-0347) and would be impacted by the proposed activity.

Subsequently, an Aboriginal Heritage Impact Permit (AHIP) was applied for under s.90 of the *National Parks and Wildlife Act 1974* to allow harm to Aboriginal objects by test excavation at the Anna Bay PAD-1 (AHIMS ID#38-5-0347) Aboriginal cultural heritage site. The AHIP (C0004974) was issued on 8 July 2019.

The test excavation was carried out over three days from 23 to 25 July 2019. Sixteen test pits, measuring 50 cm x 50 cm, were excavated. No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 was not an Aboriginal cultural heritage site. An Aboriginal Site Impact Recording Form (ASIRF) was submitted to the Biodiversity and Conservation Division (BCD), Department of Planning, Industry and Environment, advising of the updated status "Not a Site".

No further investigation or impact assessment is required. Works may proceed with caution without a further Aboriginal Heritage Impact Permit. Based on community consultation with the RAPs for the project, the following recommendations are made:

Recommendation 1:

- All workers are to be inducted into the site so that they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future consent with respect to Aboriginal heritage prior to and during and after construction activities.

Recommendation 2:

- In the unlikely event of the identification of artefacts within the site, work in the surrounding area is to stop immediately. A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site. In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material. If the material is an Aboriginal object, the proponent will:

- Notify the BCD's Enviroline and representatives of the RAPs;
- Facilitate, in co-operation with the appropriate authorities and the RAPs, the recording and assessment of the finds;
- Comply with any legal requirements and BCD directions; and
- Develop and implement appropriate management strategies based on an assessment of significance of the finds.

Recommencement of ground disturbance works may only resume once legal requirements are fulfilled.

Recommendation 3:

- All workers are to be inducted into the site so that they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of consent prior to and during and after construction activities.
- In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact must cease immediately. The location, including a 20 m curtilage, must be secured using barrier fencing to avoid further harm. The NSW Police must be contacted immediately. No further work is to be undertaken until the NSW Police provide written notification to proceed. If the skeletal remains are identified as Aboriginal, the proponent or their agent must notify the BCD's Enviroline and representatives of the RAPs. No works are to continue until the BCD provides written notification to the proponent or their agent. An Aboriginal Heritage Impact Permit may be required to manage human remains.

Historic Heritage Impacts

An expert Historic Heritage Assessment was commissioned for the proposed development and was prepared by Niche Environment and Heritage (2018) (see **Appendix F**).

There are no listed heritage items within, or directly adjacent to the subject site.

Based on the results of background heritage register searches, a visual assessment of the subject site, and an impact assessment prepared in accordance with the Statements of Heritage Impact guidelines published by the NSW Heritage Office and Department of Urban Affairs & Planning (1996, revised 2002) and best practice as outlined by the *NSW Heritage Manual* it is recommended that:

In the event that historical archaeological relics are unexpectedly exposed during excavation, ground disturbance works should stop in the affected area and a suitably qualified historical archaeologist be engaged to assess the extent, condition and likely significance of the remains. Depending on the significance of the relics, notification of the discovery may be required in accordance with S.146 of the *Heritage Act 1977* and further approval may be required if impacts are proposed.

Traffic and Transport

An expert Traffic Impact Assessment was commissioned for the proposed development and was prepared by Better Transport Futures (2018) (see **Appendix G**).

The proposed development is intended to operate between the hours of 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays. No operations are to occur on Sundays or public holidays.

There will be a maximum of 40 truck movements into and out of the site per day.

The traffic impact assessment advises that there will be a maximum 0.5% increase in traffic volumes on Nelson Bay Road as a result of the proposed development and that the capacity of Nelson Bay Road is acceptable for the purposes of the development.

The construction of a basic left turn Austroads treatment (BAL) is recommended for the traffic egress purposes.

Land Resources

An expert Geotechnical and Groundwater Investigation was commissioned for the proposed development and was prepared by RCA Australia (2018) (see **Appendix A**).

A subsurface investigation was undertaken to assess the soil and groundwater conditions across the site. The investigation comprised the drilling of bores up to 12 metres deep, construction of groundwater monitoring wells, infiltration testing and laboratory testing of the soils for particle size distribution and presence of acid sulfate soils. Soils beneath the site comprise a quartzose aeolian sand profile.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. Groundwater was encountered at a depth of approximately 2m AHD. Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand extraction during wet climatic periods.

The sand mining operations are not expected to encounter actual acid sulfate (AAS) or potential acid sulfate soils (PASS).

With regard to geotechnical stability of the batter associated with the sand mine, it is recommended that when the mine is not actively loading out that batters be limited to a maximum of 1.5H:1V and for long term stability against mass failure that the slopes be battered at a maximum 2H:1V.

Waste Management

An expert Waste Management Investigation was commissioned for the proposed development and was prepared by Advitech Environmental (2018) (see **Appendix H**).

Waste generated from the site will include remnants of native vegetation, excess construction material from the Site Office and Manager's Residence, blackwater, greywater and domestic waste.

Native vegetation will be mulched on site.

Blackwater and greywater will be treated via approved on-site waste disposal facilities.

Excess construction materials will be removed from the site and recycled where possible.

Other non-recyclable construction waste will be removed to an approved Council landfill site.

Domestic waste will be removed via the approved Council collection service.

Bushfire Hazard and Protection

An expert Bushfire Threat Assessment was commissioned for the proposed development and was prepared by Tattersall Lander (2018) (see **Appendix I**).

The bushfire threat assessment has concluded that the proposal is compliant with Planning for Bush Fire Protection. Specifically, it is noted that there will be adequate asset protection zones provided to the Site Office and Manager's Residence and that appropriate utilities and services, and acceptable means for access and egress will also be provided in the instance of a bush fire emergency.

Visual Impact

An expert Visual Impact Assessment was commissioned for the proposed development and was prepared by Tattersall Lander (2018) (see **Appendix J**).

Alterations to visual characteristics at the site include changes to the reduced formation of the sand dune and the erection of the site office and manager's residence. Visual impacts from the proposed development are minimal, resulting in negligible or unaltered visual impact from the foreshore, surrounding properties and from Nelson Bay Road.

Social Impact

An expert Social Impact Assessment was commissioned for the proposed development and was prepared by Tattersall Lander (2018) (see **Appendix K**).

The Social Impact Assessment identified a range of stakeholder considerations associated with the proposal.

Due to the limited physical nature of the proposed development (including requirements to remove sand under the electricity easement for Ausgrid maintenance purposes), the primary nature of discussion by the public was centred on questions and comments rather than commentary by way of specific objection due to perception of adverse impacts.

Relevant community and technical mitigation strategies have been cited in the assessment to address the variety of considerations which have been raised by both the public and by other stakeholders.

The proposed development incorporates a significant number of specific mitigation strategies in relation to the following considerations, as well as providing an associated Statement of Commitments:

- Traffic Impacts
- Ecological Impacts
- Noise and Vibration
- Air Quality
- Aboriginal Cultural Heritage

As is the case with many resource extraction projects, the perceived and experienced social impacts/ issues are often greatest for those living in closest proximity to the proposal, or those who perceive they will be most directly impacted by the development. Consequently, should the development proceed, an appropriate social impact monitoring program should be developed to assess the degree to which impacts are occurring and appropriate methodologies by which to mitigate any impacts.

It will be vital for the proponent to maintain an ongoing dialogue with local residents throughout the operation of the sand mine in relation to issues of relevance and importance to the community.

Economic Impact

The proposed operation will only source workers from the Port Stephens and local regional areas, so creating local sustainable jobs. The proposed sand mine provides an opportunity for local employment at Anna Bay and other local and regional businesses through the multiplier effect. The proposed sand extraction through the life of the mining operations will allow for the continued employment of local workers.

6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months. Similarly, 6 part-time employee positions will be required for internal road construction purposes for 2 months. 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site. The proposed sand extraction facility will contribute to the up-skilling of the local workforce in training and development of staff.

The approval of the sand extraction operation will see jobs generated for up to 30 years.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

Rehabilitation

An expert Geotechnical and Groundwater Investigation was commissioned for the proposed development and was prepared by RCA Australia (2018) (see **Appendix A**).

With regard to geotechnical stability of the batter associated with the sand mine, it is recommended that when the mine is not actively loading out that batters be limited to a maximum of 1.5H:1V and for long term stability against mass failure that the slopes be battered at a maximum 2H:1V. Final rehabilitation will ensure that slopes are battered for long term stability against mass failure.

Southerly dune faces will be mass planted with spinifex species.

Consultation

As detailed in the Social Impact Assessment, a Public Meeting was held at the Anna Bay/Birubi Point Community Hall on 12 September, 2018. The purpose of the meeting was to enable the proponent to discuss the detail of the proposed development and to enable members of the community to ask questions and address any particular concerns.

Matters raised by the public have been considered as part of the Social Impact Assessment and preparation of the EIS.

Consultation has also occurred with government agencies.

Government agencies were initially notified of the proposal by the then Department of Planning prior to the issue of the Secretary's Environmental Assessment

Requirements (SEARs). Following the issue of the SEARs, the relevant government departments were contacted by the applicant to establish whether there were other matters which were required to be addressed in addition to matters outlined in the SEARs. Relevant matters are included throughout the EIS.

Justification

There is a requirement to maintain the electrical easement free of obstruction. Southerly winds are resulting in continuous sand deposition, causing an ongoing issue with the ability to maintain the easement. The accumulation of these sands is a primary electricity maintenance consideration, and also a potential safety issue.

The removal of the sand from this easement is able to be undertaken on behalf of Ausgrid without consent, however, removal of sand south of this easement requires consent. Removal of sand to the south of the Ausgrid easement, provides an effective buffer to its accumulation within the easement.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the EIS has been prepared having regard to the impacts created at that level.

It is expected that through the implementation of the recommended mitigation measures, the proposal will not have any significant impacts.

The project can be implemented with minimal adverse socio-economic and environmental impacts as demonstrated throughout the EIS.

The project is justified on the basis of the efficient utilisation of available existing resources; maintenance of the existing electricity easement and overall economic benefits to local, regional and State economies.

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APPENDICES

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Appendix B: Acoustic Assessment

Appendix C: Air Quality Assessment

Appendix D: Biodiversity Assessment

Appendix E: Aboriginal Cultural Heritage Assessment

Appendix F: Historic Heritage Assessment

Appendix G: Traffic and Transport Assessment

Appendix H: Waste Assessment

Appendix I: Bushfire Assessment

Appendix J: Visual Impact Assessment

Appendix K: Social Impact Assessment

1 INTRODUCTION

Tattersall Lander Pty Limited is engaged by Hay Enterprises (NSW) Pty. Ltd. to prepare an Environmental Impact Statement (EIS) for a proposed sand extraction enterprise at 4226 Nelson Bay Road, Anna Bay. An ancillary Site Office and associated Manager's residence is also proposed.

The proposed development is both designated development and integrated development pursuant to the provisions and requirements of the *Environmental Planning and Assessment Act (1979)* (the EP&A Act) and the *Environmental Planning and Assessment Regulation (2000)* (the EP&A Regulation).

The NSW Department of Planning and Environment has been consulted and the Department issued Secretary's Environmental Assessment Requirements (SEARs) on 27 October 2017.

The development constitutes a scheduled activity (extractive industry) pursuant to the *Protection of the Environment Operations Act 1997* (POEO Act) requiring an Environment Protection Licence (EPL).

This report has been prepared by Tattersall Lander Pty. Ltd. and addresses the key issues outlined in the SEARs. Specialist reports have been prepared by the key consultants and are reproduced in the appendices to the EIS.

The EIS aims to quantify and discuss the potential impacts of the proposed development and recommends appropriate mitigation measures to ameliorate the potential impacts.

This report is intended for use by statutory authorities for the purposes of determination of the application.

Tattersall Lander will not accept any liability for use of the information contained within this report or the appendices, other than that for the purpose for which this report was prepared.

2 DEVELOPMENT OUTLINE

2.1 Proposed Development

Hay Enterprises (NSW) Pty. Ltd. proposes to establish a sand extraction facility on Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay. The construction of an ancillary Site Office and Manager's Residence is also proposed at the site.

The proposed operations seek to remove wind deposited sand to natural ground level within an existing 33kV electrical easement and land immediately south of this easement. The proposal seeks to extract and remove up to 50,000 cubic metres (maximum) of sand per year over a 30-year period.

The proposed sand extraction facility will provide a sand resource suitable for general purposes in the construction industry. Importantly, removal of windblown sand will also ensure that the 33KV electricity easement within the site is kept clear of sand and can be accessed for maintenance purposes.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

The sand resource is intended for general construction and bulk land filling purposes in various locations; primarily Newcastle and the Hunter Valley. The product will be classified as VENM (Virgin Excavated Natural Material). Sand will be loaded via a front-end loader into haulage trucks and removed from the site to market destinations via Nelson Bay Road.

The proposed development is intended to operate between the hours of 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays. No operations are to occur on Sundays or public holidays.

There will be a maximum of 40 truck movements into and out of the site per day.

The proposed operation will only source workers from the Port Stephens and local regional areas, so creating local sustainable jobs. The proposed sand mine provides an opportunity for local employment at Anna Bay and other local and regional businesses through the multiplier effect. The proposed sand extraction through the life of the mining operations will allow for the continued employment of local workers.

6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months. Similarly, 6 part-time employee positions will be required for internal road construction purposes for 2 months. 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site. The proposed sand

extraction facility will contribute to the up-skilling of the local workforce in training and development of staff.

The approval of the sand extraction operation will see jobs generated for up to 30 years.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the EIS has been prepared having regard to the impacts created at that level.

2.2 Site Description and Existing Land Uses

The legal description of the site is Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay.

The land is 13.12 hectares in size and is zoned RU2 Rural Landscape pursuant to Port Stephens Local Environmental Plan (LEP) 2013.

The property is largely rural in nature. An existing dwelling and shed are located on the site.

The site has direct access to Nelson Bay Road.

The electrical easement is situated towards the south of the site.

The following figures and plates illustrate site context and characteristics.



Figure 2-1: Proposed Development Site

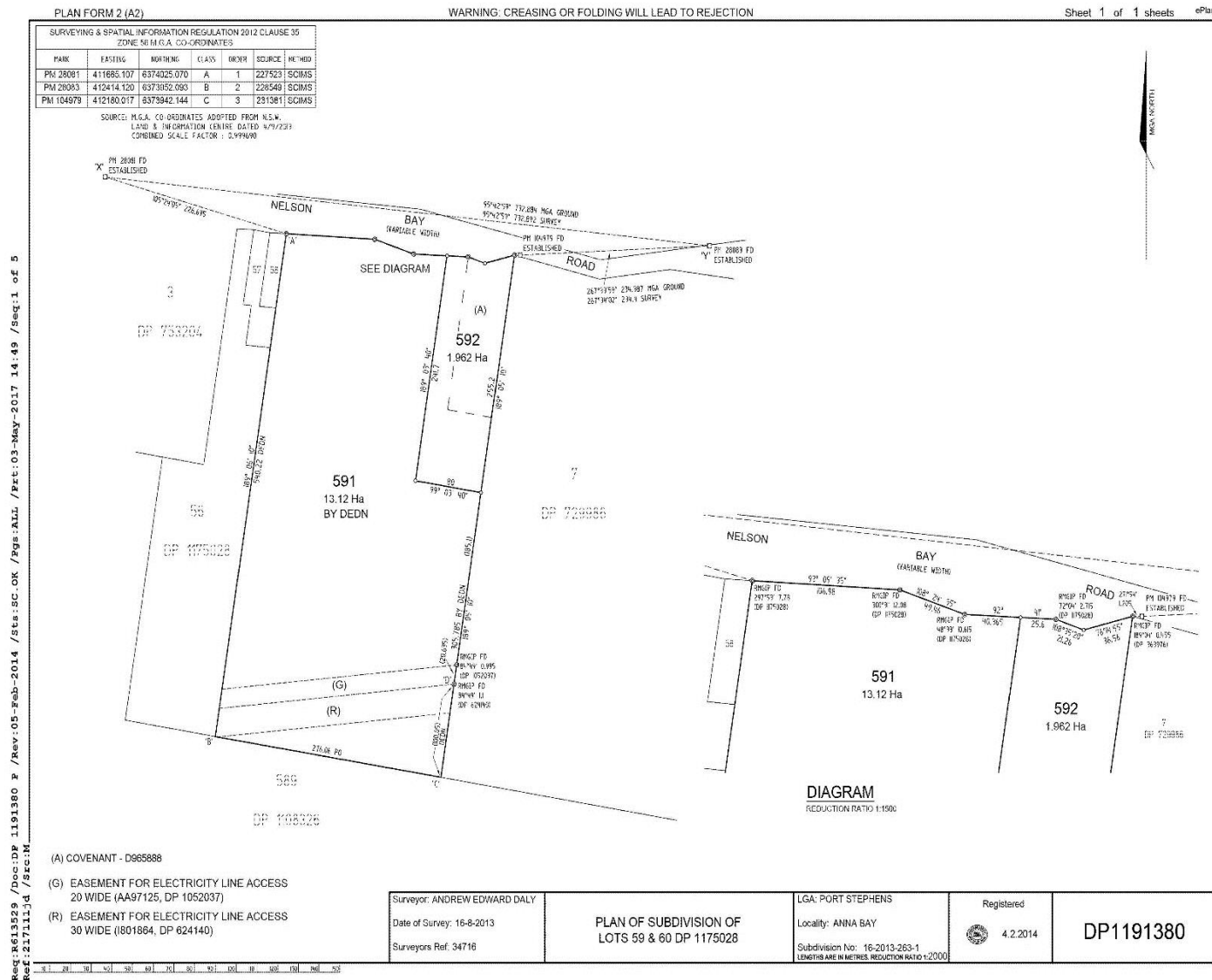
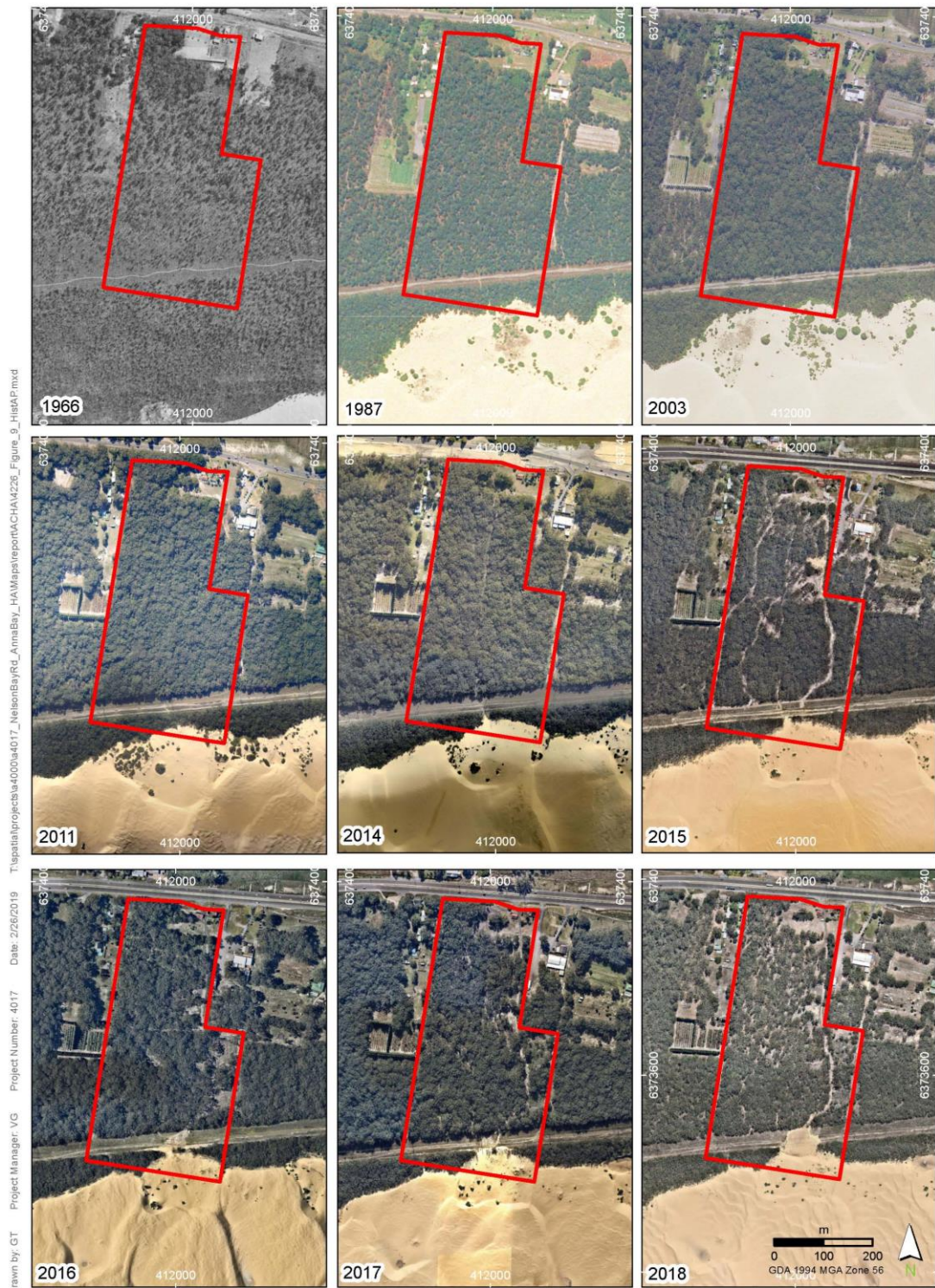


Figure 2-2: Deposited Plan 1191380



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Historical aerial photographs

4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

niche
Environment and Heritage

FIGURE 9

Imagery: (c) LPI 1966-2009, NearMap 2010-2018

Figure 2-3: Depiction of Historical Wind-Blown Sand Incursion Over Time (1966-2018)

Source: Niche Environment & Heritage 2018



Plate 2-1: Site Access Location: View East along Nelson Bay Road



Plate 2-2: Site Access: View South into the Site at Intersection with Nelson Bay Road



Plate 2-3: Existing Site Access and Vegetation: View South



Plate 2-4: Existing Site Access: Approaching 33kV Electricity Easement from North



Plate 2-5: View North-West from Distant Sand Dunes: 33kV Electricity Network in Background



Plate 2-6: View East along 33kV Electricity Network: Poles, Wires, Easement and Part of Sand Incursion



Plate 2-7: View South-East from Easement - Part of Wind-Blown Sand Incursion and Associated Vegetation Destruction



Plate 2-8: View South-West from Easement - Part of Wind-Blown Sand Incursion and Associated Vegetation Destruction



Plate 2-9: On Top of Wind-Blown Sand Dune Incursion - View South-West and Showing Associated Vegetation Destruction



Plate 2-10: View East Along Electricity Easement Following Emergency Removal of Sand Incursion Under Easement



**Plate 2-11: View South - West through Electricity Easement Following Emergency Removal
of Sand Incursion Under Easement**

3 CONSULTATION

As detailed in the Social Impact Assessment (**Chapter 17** and **Appendix K**), a Public Meeting was held at the Anna Bay/Birubi Point Community Hall on 12 September, 2018. The purpose of the meeting was to enable the proponent to discuss the detail of the proposed development and to enable members of the community to ask questions and address any particular concerns.

Matters raised by the public have been considered as part of the Social Impact Assessment and preparation of the EIS.

Consultation has also occurred with government agencies.

Government agencies were initially notified of the proposal by the then Department of Planning prior to the issue of the Secretary's Environmental Assessment Requirements (SEARs). Following the issue of the SEARs, the relevant government departments were contacted by the applicant to establish whether there were other matters which were required to be addressed in addition to matters outlined in the SEARs (see **Table 3-1**). Relevant matters are included throughout the EIS.

Agency	Contact	Date(s) of Contact	Method of Contact	Outcome
Port Stephens Council	Cindy Littlewood	9 January 2019	Email	No response
Office of Environment & Heritage	Steve Lewer	9 January 2019	Email	No response
Environment Protection Agency	Steve Clair	9 January 2019	Email	Advice to ensure that "Noise Policy for Industry 2017" has been considered as part of the acoustic report.
DPI Water	Alison Collaros	9 January 2019	Email	Email received stating no additional requirements.
Roads & Maritime Services	Peter Marler	9 January 2019	Email	No response
NSW Rural Fire Service	Bradford Sellings	9 January 2019	Email	Email received advising that Planning for Bushfire 2006 is to be addressed, including the aims and objectives.
Hunter Local Land Services	Jacqueline Myhill	9 January 2019	Email	No response
Hunter Water	Malcolm Withers	9 January 2019	Email	No response
Ausgrid	John Oswald	9 January 2019	Email	Advised that any works within the easement are to be approved by Ausgrid.

Table 3-1: Additional Consultation with Authorities and Agencies Post Release of SEARs

4 SECRETARY'S ENVIRONMENTAL ASSESSMENT REQUIREMENTS

SEARs for the proposed development were issued by the Department on 27 October, 2017. SEARs are reproduced as Table 4.1. Table 4.1 also illustrates the EIS SEARs response location.

Table 4-1: Secretary's Environmental Requirements and Response Location Within the EIS

Secretary's Environmental Assessment Requirements	Location within the EIS
General Requirements	
The EIS must meet the form and content requirements in clauses 6 and 7 of Schedule 2 of the <i>Environmental Planning and Assessment Regulation</i>	
Clause 6 – Form Requirements An environmental impact statement must contain the following information: a) the name, address and professional qualifications of the person by whom the statement is prepared, b) the name and address of the responsible person, c) the address of the land: (i) in respect of which the development application is to be made, or (ii) on which the activity or infrastructure to which the statement relates is to be carried out, d) a description of the development, activity or infrastructure to which the statement relates, e) an assessment by the person by whom the statement is prepared of the environmental impact of the development, activity or infrastructure to which the statement relates, dealing with the matters referred to in this Schedule, f) a declaration by the person by whom the statement is prepared to the effect that: (i) the statement has been prepared in accordance with this Schedule, and (ii) the statement contains all available information that is relevant to the environmental assessment of the development, activity or infrastructure to which the statement relates, and (iii) that the information contained in the statement is neither false nor misleading.	Declaration
Clause 7 – Content Requirements	
(a) a summary of the environmental impact statement	Executive Summary

(b) a statement of the objectives of the development, activity or infrastructure	Executive Summary and Chapter 1
(c) an analysis of any feasible alternatives to the carrying out of the development, activity or infrastructure, having regard to its objectives, including the consequences of not carrying out the development, activity or infrastructure	Chapter 19
(d) an analysis of the development, activity or infrastructure, including: i. a full description of the development, activity or infrastructure, and ii. a general description of the environment likely to be affected by the development, activity or infrastructure, together with a detailed description of those aspects of the environment that are likely to be significantly affected, and iii. the likely impact on the environment of the development, activity or infrastructure, and iv. a full description of the measures proposed to mitigate any adverse effects of the development, activity or infrastructure on the environment, and v. a list of any approvals that must be obtained under any other Act or law before the development, activity or infrastructure may lawfully be carried out	Chapters 1-21 and Appendices A - K
(e) a compilation (in a single section of the environmental impact statement) of the measures referred to in item (d)(iv)	Chapter 20
(f) the reasons justifying the carrying out of the development, activity or infrastructure in the manner proposed, having regard to biophysical, economic and social considerations, including the principles of ecologically sustainable development	Chapters 1-21
Key Issues	
Water - including: ▪ an assessment of any volumetric licensing requirements, including a description of site water demands, water disposal methods (inclusive of volume and frequency of any water discharges), water supply infrastructure and water storage structures; ▪ identification of any licensing requirements or other approvals required under the <i>Water Act 1912</i> and/or <i>Water Management Act 2000</i>. ▪ demonstration that water for the construction and operation of the development can be obtained from an appropriately authorised and reliable supply in accordance with the operating rules of any relevant Water Sharing Plan (WSP); ▪ a description of the measures proposed to ensure the development can operate in accordance with the requirements of any relevant Water Sharing Plan or water source embargo;	Chapter 6 Appendix A

▪ a detailed consideration of maintenance of an adequate buffer between all excavations at the highest predicted groundwater table; ▪ an assessment of activities that could cause erosion or sedimentation issues, and the proposed measures to prevent or control these impacts including coastal hazards and coastal processes; ▪ an assessment of potential impacts on the quality and quantity of existing surface and ground water resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives; and ▪ a detailed description of the proposed water management system, water monitoring program and other measures to mitigate surface and groundwater impacts.	
Noise – including a quantitative assessment of potential: ▪ construction and operational noise and off-site transport noise impacts of the development in accordance with the <i>Interim Construction Noise Guideline</i>, <i>NSW Industrial Noise Policy</i> and <i>NSW Road Noise Policy</i> respectively; ▪ reasonable and feasible mitigation measures to minimise noise emissions; and ▪ monitoring and management measures.	Chapter 7 Appendix B
Air – including an assessment of the likely air quality impacts of the development in accordance with the <i>Approved Methods for the Modelling and Assessment of Air Pollutants in NSW</i>. The assessment is to give particular attention to potential dust impacts on any nearby private receivers due to construction activities, the operation of the quarry and/or road haulage.	Chapter 8 Appendix C
Biodiversity – including: ▪ accurate predictions of any vegetation clearing on the site; ▪ a detailed assessment of the potential biodiversity impacts of the development in accordance with the Biodiversity Assessment Method (BAM), paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems; ▪ a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant; ▪ an assessment of whether a Species Impact Statement is required; and ▪ consideration of weed management.	Chapter 9 Appendix D
Heritage – including: ▪ an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant	Chapters 10 and 11

Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage; and ▪ identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant policies and guidelines listed in Attachment 1.	Appendices E and F
Traffic and Transport – including: ▪ accurate predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products; ▪ an assessment of potential traffic impacts on the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development; ▪ evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and ▪ a description of access roads, specifically in relation to nearby Crown roads and fire trails.	Chapter 12 Appendix G
Land Resources – including an assessment of: ▪ potential impacts on soils and land capability (including potential erosion and land contamination) and the proposed mitigation, management and remedial measures (as appropriate); ▪ potential impacts on acid sulfate soils including proposed management strategies; ▪ potential impacts on land forms (topography), paying particular attention to the long-term geotechnical stability of any new landforms, and ▪ the compatibility of the development with other land uses in the vicinity of the development, in accordance with the requirements of Clause 12 of <i>State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007</i>;	Chapter 13 Appendix A
Waste – including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams.	Chapter 14 Appendix H
Hazards – including an assessment of the likely risks to public safety, paying particular attention to potential bush fire risks and the transport, storage, handling and use of any hazardous or dangerous goods.	Chapter 15 Appendix I
Visual – including an assessment of the likely visual impacts of the development on private landowners in the vicinity of the development and key vantage points in the public domain.	Chapter 16 Appendix J

Social and Economic – an assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project.	Chapter 17 Appendix K
Rehabilitation – including: ▪ a detailed description of the proposed rehabilitation measures that would be undertaken throughout the development and during quarry closure; ▪ a detailed rehabilitation strategy, including justification for the proposed final landform and consideration of the objectives of any relevant strategic land use plans or policies; and ▪ the measures that would be undertaken to ensure sufficient financial resources are available to implement the proposed rehabilitation strategy, recognising that a rehabilitation bond will likely be required as a condition of any future development consent.	Chapter 18

5 REGULATORY FRAMEWORK

5.1 Commonwealth Legislation

5.1.1 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act) requires approval from the Commonwealth Minister for the Department of Environment and Energy (DoEE) for any activity that is considered likely to have a significant impact on Matters of National Environmental Significance (MNES). MNES categories listed under the EPBC Act include:

- World heritage properties;
- National heritage places;
- Wetlands of international importance (Ramsar wetlands);
- Threatened species and ecological communities;
- Migratory species;
- Commonwealth marine areas;
- Nuclear actions (including the mining or uranium);
- A water resource, in relation to coal seam gas development and large coal mining development.

The Biodiversity Development Assessment Report (BDAR) prepared by Wildthing Environmental Consultants (see **Chapter 9** and **Appendix D**) concludes that the proposal is unlikely to have a significant impact on any MNES and therefore it is not required to be referred to the DoEE for approval.

5.1.2 Aboriginal & Torres Strait Islander Heritage Protection Act 1984

The Aboriginal and Torres Strait Islander Heritage Protection Act 1984 (the ATSIHP Act) provides for the preservation and protection of places, areas and objects of particular significance to Indigenous Australians. The stated purpose of the ATSIHP Act is the “preservation and protection from injury or desecration of areas and objects in Australia and in Australian waters, being areas and objects that are of particular significance to Aboriginals in accordance with Aboriginal tradition” (Part I, Section 4).

Under the Act, 'Aboriginal tradition' is defined as "the body of traditions, observances, customs and beliefs of Aboriginals generally or of a particular community or group of Aboriginals, and includes any such traditions, observances, customs or beliefs relating to particular persons, areas, objects or relationships" (Part I, Section 3). A 'significant Aboriginal area' is an area of land or water in Australia that is of "particular significance to Aboriginals in accordance with Aboriginal tradition" (Part I, Section 3). A 'significant Aboriginal object', on the other hand, refers to an object (including Aboriginal remains) of like significance.

For the purposes of the Act, an area or object is considered to have been be injured or desecrated if:

- a) In the case of an area:
 - i. it is used or treated in a manner inconsistent with Aboriginal tradition;
 - ii. the use or significance of the area in accordance with Aboriginal tradition is adversely affected; and
 - iii. passage through, or over, or entry upon, the area by any person occurs in a manner inconsistent with Aboriginal tradition
- b) in the case of an object:
 - i. it is used or treated in a manner inconsistent with Aboriginal tradition.

The ATSIHP Act can override state and territory laws in situations where a state or territory has approved an activity, but the Commonwealth Minister prevents the activity from occurring by making a declaration to protect an area or object. However, the Minister can only make a decision after receiving a legally valid application under the ATSIHP Act and, in the case of long-term protection, after considering a report on the matter. Before making a declaration to protect an area or object in a state or territory, the Commonwealth Minister must consult the appropriate minister of that state or territory (Part 2, Section 13).

An assessment of the proposed development against Aboriginal Cultural Heritage considerations is provided in **Chapter 10**. A copy of the Aboriginal Cultural Assessment Report is located at **Appendix E**.

5.2 NSW State Legislation

5.2.1 Environmental Planning & Assessment Act 1979 and Environmental Planning & Assessment Regulation 2000

The primary piece of state legislation for development in NSW is the EP&A Act (and the associated EP&A Regulation). The objectives of the EP&A Act are:

- a) *to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,*
- b) *to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,*
- c) *to promotes the orderly and economic use and development of land,*
- d) *to promote the delivery and maintenance of affordable housing,*
- e) *to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,*
- f) *to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),*
- g) *to promote good design and amenity of the built environment,*
- h) *to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,*
- i) *to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,*
- j) *to provide increased opportunity for community participation in environmental planning and assessment.*

The EIS analyses the proposed development on economic, environmental and social grounds.

Schedule 3 of the *EP&A Regulation* prescribes development which is "designated development" under the *EP&A Act*. Specifically, Part 1, Clause 19 of Schedule 3 states:

“19 Extractive industries

(1) Extractive industries (being industries that obtain extractive materials by methods including excavating, dredging, tunnelling or quarrying or that store, stockpile or process extractive materials by methods including washing, crushing, sawing or separating):

(a) that obtain or process for sale, or reuse, more than 30,000 cubic metres of extractive material per year, or

(b) that disturb or will disturb a total surface area of more than 2 hectares of land by:

(i) clearing or excavating, or

(ii) constructing dams, ponds, drains, roads or conveyors, or

(iii) storing or depositing overburden, extractive material or tailings, or

(c) that are located:

(i) in or within 40 metres of a natural waterbody, wetland or an environmentally sensitive area, or

(ii) within 200 metres of a coastline, or

(iii) in an area of contaminated soil or acid sulphate soil, or

(iv) on land that slopes at more than 18 degrees to the horizontal, or

(v) if involving blasting, within 1,000 metres of a residential zone or within 500 metres of a dwelling not associated with the development, or

(vi) within 500 metres of the site of another extractive industry that has operated during the last 5 years”.

The proposal is identified as “designated development” for the following reasons:

- the proposal will exceed 30,000 cubic metres per year; and
- the proposal is within 500 metres of the site of another extractive industry that is either currently operating or has operated within the last 5 years (see **Figure 5-1**)



Figure 5-1: Adjoining Sand Extraction Operations

- Whilst geotechnical investigation has demonstrated otherwise, the proposed development is also located in an area mapped as containing acid sulfate soils and potential acid sulfate soils.

The classification of the proposal as “designated development” requires an EIS to be submitted with the development application.

As the proposed development is ‘designated’, Schedule 2 of the *EP&A Regulation* requires the relevant party to make an application to the Departmental Secretary to obtain the SEARs. This EIS has been prepared in accordance with the relevant requirements as outlined in the *EP&A Regulation*, Schedule 2, Parts 2 and 3.

Table 4.1 Section 4.0 clearly identifies the SEARs and the location of these requirements within the EIS.

Section 4.46 of the *EP& Act* identifies integrated development. Integrated development is development which requires the consent of another government authority. As well as being ‘designated development’, the proposed development is also ‘integrated development’ pursuant to section 4.46 of the *EP&A Act* as the development constitutes a scheduled activity (extractive industry) pursuant to the *Protection of the Environment Operations Act 1997* requiring an Environment Protection Licence (EPL) pursuant to sections 43(b), 48 and 55.

5.2.2 Protection of the Environment Operations Act 1997

The proposed development seeks to extract a maximum of 50,000 cubic metres (volume) of sand per annum. 50,000 cubic metres of this sand resource approximates a weight of 76,500 metric tonnes.

As previously stated, the development constitutes a land-based scheduled activity (extractive industry seeking to extract more than 30,000 tonnes of sand per annum) pursuant to the *Protection of the Environment Operations Act 1997* (POEO Act) requiring an Environment Protection Licence (EPL) pursuant to Sections 43(b), 48 and 55 and Schedule 1.

Part 1 clause 19 of Schedule 1 of the POEO Act applies relevantly as follows:

“19 Extractive activities

(1) This clause applies to the following activities:

land-based extractive activity, meaning the extraction, processing or storage of extractive materials, either for sale or re-use, by means of excavation, blasting, tunnelling, quarrying or other such land-based methods.

(2) In this clause, **extractive materials** means clay, sand, soil, stone, gravel, rock, sandstone or similar substances that are not minerals within the meaning of the [Mining Act 1992](#).

(3) Each activity referred to in Column 1 of the Table to this clause is declared to be a scheduled activity if it meets the criteria set out in Column 2 of that Table.

Table 1

Column 1	Column 2
Activity	Criteria
land-based extractive activity	involves the extraction, processing or storage of more than 30,000 tonnes per year of extractive material”.

5.2.3 Biodiversity Conservation Act 2016

The *Biodiversity Conservation Act 2016* (BC Act) lists threatened species, populations and ecological communities under Schedules 1 and 2 of the Act, that are priorities for conservation within NSW. Schedule 4 of the BC Act lists Key Threatening Processes for species, populations and ecological communities within NSW.

The EP&A Act lists factors that must be taken into account in the determination of the significance of potential impacts of a proposed development on threatened species, populations or ecological communities (or their habitats) listed under the Biodiversity Conservation Act. In August 2017, the BC Act commenced operation and changed the way impacts to biodiversity are assessed and offset in NSW, with offsetting required for any projects exceeding certain clearing thresholds outlined in the Biodiversity Conservation Regulation 2017.

The assessment of the proposed development having regard to the requirements of the BC Act is provided in **Chapter 9**. A copy of the Biodiversity Assessment Report is located at **Appendix D**.

5.2.4 National Parks & Wildlife Act 1974

The *National Parks and Wildlife Act 1974* (NP&W Act) guides the management of conservation areas as well as the protection of native vegetation, native fauna and Aboriginal objects across the State. Under the NP&W Act it is illegal to move, damage, deface or destroy a relic without written permission from the Biodiversity & Conservation Division of the Department of Planning, Industry and Environment.

Under Section 5 of the Act, “Aboriginal Object” means any deposit, object or material evidence (not being a handicraft made for sale) relating to the Aboriginal habitation of the area that comprises New South Wales, being habitation before or concurrent with (or both) the occupation of that area by persons of non-Aboriginal extraction, and includes Aboriginal remains. All Aboriginal objects within the State of New South Wales are protected under Section 90 of the NP&W Act.

The NP&W Act provides responsibility to the Director-General of the Biodiversity & Conservation Division of the Department of Planning, Industry and Environment for the proper care, preservation and protection of ‘Aboriginal objects’ and ‘Aboriginal places’, defined under the Act as follows:

- An *Aboriginal object* is any deposit, object or material evidence (that is not a handicraft made for sale) relating to Aboriginal habitation of NSW, before or during the occupation of that area by persons of non-Aboriginal extraction (and includes Aboriginal remains).
- An *Aboriginal place* is a place declared so by the Minister administering the NPW Act because the place is or was of special significance to Aboriginal culture. It may or may not contain Aboriginal objects.

Part 6 of the NP&W Act provides specific protection for Aboriginal objects and places by making it an offence to harm them and includes a ‘strict liability offence’ for such harm. A ‘strict liability offence’ does not require someone to know that it is an Aboriginal object or place they are causing harm to in order to be prosecuted. Defences against the ‘strict liability offence’ in the NP&W Act include the carrying out of certain ‘Low Impact Activities’, prescribed in Clause 80B of the *National Parks and Wildlife Amendment Regulation 2010* (NP&W Regulation), and the demonstration of due diligence.

An Aboriginal Heritage Impact Permit (AHIP) issued under Section 90 of the NP&W Act is required if impacts to Aboriginal objects and/or places cannot be avoided. An AHIP is a defence to a prosecution for harming Aboriginal objects and places if the harm was authorised by the AHIP and the conditions of that AHIP were not contravened. Consultation with Aboriginal communities is required under OEH policy when an application for an AHIP is considered and is an integral part of the process. AHIPs may be issued in relation to a specified Aboriginal object, Aboriginal place, land, activity or person or specified types or classes of Aboriginal objects, Aboriginal places, land, activities or persons.

An assessment of the proposed development against Aboriginal Cultural Heritage considerations is provided in **Chapter 10**. A copy of the Aboriginal Cultural Assessment Report is located at **Appendix E**.

5.2.5 Coastal Management Act 2016

The objects of the *Coastal Management Act 2016* (CMA Act) are to manage the coastal environment of NSW in a manner consistent with the principles of ecologically sustainable development for the social, cultural and economic well-being of the people of the State, and in particular:

- (a) to protect and enhance natural coastal processes and coastal environmental values including natural character, scenic value, biological diversity and ecosystem integrity and resilience, and
- (b) to support the social and cultural values of the coastal zone and maintain public access, amenity, use and safety, and
- (c) to acknowledge Aboriginal peoples' spiritual, social, customary and economic use of the coastal zone, and
- (d) to recognise the coastal zone as a vital economic zone and to support sustainable coastal economies, and
- (e) to facilitate ecologically sustainable development in the coastal zone and promote sustainable land use planning decision-making, and
- (f) to mitigate current and future risks from coastal hazards, taking into account the effects of climate change, and
- (g) to recognise that the local and regional scale effects of coastal processes, and the inherently ambulatory and dynamic nature of the shoreline, may result in the loss of coastal land to the sea (including estuaries and other arms of the sea), and to manage coastal use and development accordingly, and
- (h) to promote integrated and co-ordinated coastal planning, management and reporting, and
- (i) to encourage and promote plans and strategies to improve the resilience of coastal assets to the impacts of an uncertain climate future including impacts of extreme storm events, and
- (j) to ensure co-ordination of the policies and activities of government and public authorities relating to the coastal zone and to facilitate the proper integration of their management activities, and
- (k) to support public participation in coastal management and planning and greater public awareness, education and understanding of coastal processes and management actions, and

- (l) to facilitate the identification of land in the coastal zone for acquisition by public or local authorities in order to promote the protection, enhancement, maintenance and restoration of the environment of the coastal zone, and
- (m) to support the objects of the [Marine Estate Management Act 2014](#).

The CM Act also provides definition and clarification of the various coastal zones and management objectives with the Coastal Zone being land comprised as:

- (a) the coastal wetlands and littoral rainforests area,
- (b) the coastal vulnerability area,
- (c) the coastal environment area,
- (d) the coastal use area.

Section 8 of the CM Act applies to the coastal environment area, of which a small component of the land is a part (see discussion Section 5.3, Coastal SEPP), viz:

"8 Coastal environment area

- (1) *The coastal environment area means the land identified by a State environmental planning policy to be the coastal environment area for the purposes of this Act, being land containing coastal features such as the coastal waters of the State, estuaries, coastal lakes, coastal lagoons and land adjoining those features, including headlands and rock platforms.*
- (2) *The management objectives for the coastal environment area are as follows:*
 - (a) *to protect and enhance the coastal environmental values and natural processes of coastal waters, estuaries, coastal lakes and coastal lagoons, and enhance natural character, scenic value, biological diversity and ecosystem integrity,*
 - (b) *to reduce threats to and improve the resilience of coastal waters, estuaries, coastal lakes and coastal lagoons, including in response to climate change,*
 - (c) *to maintain and improve water quality and estuary health,*
 - (d) *to support the social and cultural values of coastal waters, estuaries, coastal lakes and coastal lagoons,*

- (e) *to maintain the presence of beaches, dunes and the natural features of foreshores, taking into account the beach system operating at the relevant place,*
- (f) *to maintain and, where practicable, improve public access, amenity and use of beaches, foreshores, headlands and rock platforms".*

5.3 State Environmental Planning Policies

The State Environmental Planning Policies (SEPPs) relevant to this proposal and/or which are required to be addressed under SEARs include:

- SEPP (Mining, Petroleum Production and Extractive Industries) 2007
- SEPP (Rural Lands) 2008
- SEPP (Coastal Management) 2018
- SEPP 33 Hazardous and Offensive Development
- SEPP 44 – Koala Habitat Protection

SEPP (Mining, Petroleum Production and Extractive Industries) 2007

This Policy applies to the State.

The aims of this SEPP are:

- a) to provide for the proper management and development of mineral, petroleum and extractive material resources for the purpose of promoting the social and economic welfare of the state, and
- b) to facilitate the orderly and economic use and development of land containing mineral, petroleum and extractive material resources, and
- b1) to promote the development of significant mineral resources, and
- c) to establish appropriate planning controls to encourage ecologically sustainable development through the environmental assessment, and sustainable management, of development of mineral, petroleum and extractive material resources, and
- d) to establish a gateway assessment process for certain mining and petroleum (oil and gas) development:
 - (i) to recognise the importance of agricultural resources, and

- (ii) to ensure protection of strategic agricultural land and water resources, and
- (iii) to ensure a balanced use of land by potentially competing industries, and
- (iv) to provide for the sustainable growth of mining, petroleum and agricultural industries.

The following clauses/subclauses of the SEPP are relevant to the determination of the development application:

5 Relationship with other environmental planning instruments

- (3) Subject to subclause (4), if this Policy is inconsistent with any other environmental planning instrument, whether made before or after this Policy, this Policy prevails to the extent of the inconsistency.
- (4) Subclause (3) does not apply to any inconsistency between this Policy and any of the following State environmental planning policies:
 - (a) *State Environmental Planning Policy (Major Projects) 2005*,
 - (b) *State Environmental Planning Policy (Coastal Management) 2018*,
 - (c) (Repealed)

regardless of when the inconsistency arises.

7 Development permissible with consent

- (3) Extractive industry

Development for any of the following purposes may be carried out with development consent:

- (a) extractive industry on land on which development for the purposes of agriculture or industry may be carried out (with or without development consent),
- (b) extractive industry in any part of a waterway, an estuary in the coastal zone or coastal waters of the State that is not in an environmental conservation zone.

12 Compatibility of proposed mine, petroleum production or extractive industry with other land uses

Before determining an application for consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must:

- (a) consider:
 - (i) the existing uses and approved uses of land in the vicinity of the development, and
 - (ii) whether or not the development is likely to have a significant impact on the uses that, in the opinion of the consent authority having regard to land use trends, are likely to be the preferred uses of land in the vicinity of the development, and
 - (iii) any ways in which the development may be incompatible with any of those existing, approved or likely preferred uses, and
- (b) evaluate and compare the respective public benefits of the development and the land uses referred to in paragraph (a) (i) and (ii), and
- (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

13 Compatibility of proposed development with mining, petroleum production or extractive industry

- (1) This clause applies to an application for consent for development on land that is, immediately before the application is determined:
 - (a) in the vicinity of an existing mine, petroleum production facility or extractive industry, or
 - (b) identified on a map (being a map that is approved and signed by the Minister and copies of which are deposited in the head office of the Department and publicly available on the Department's website) as being the location of State or regionally significant resources of minerals, petroleum or extractive materials, or

Note.

At the commencement of this Policy, no land was identified as referred to in paragraph (b).

- (c) identified by an environmental planning instrument as being the location of significant resources of minerals, petroleum or extractive materials.

Note.

Sydney Regional Environmental Plan No 9—Extractive Industry (No 2—1995) is an example of an environmental planning instrument that identifies land as containing significant deposits of extractive materials.

- (2) Before determining an application to which this clause applies, the consent authority must:
 - (a) consider:
 - (i) the existing uses and approved uses of land in the vicinity of the development, and
 - (ii) whether or not the development is likely to have a significant impact on current or future extraction or recovery of minerals, petroleum or extractive materials (including by limiting access to, or impeding assessment of, those resources), and
 - (iii) any ways in which the development may be incompatible with any of those existing or approved uses or that current or future extraction or recovery, and
 - (b) evaluate and compare the respective public benefits of the development and the uses, extraction and recovery referred to in paragraph (a) (i) and (ii), and
 - (c) evaluate any measures proposed by the applicant to avoid or minimise any incompatibility, as referred to in paragraph (a) (iii).

14 Natural resource management and environmental management

- (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring that the development is undertaken in an environmentally responsible manner, including conditions to ensure the following:

- (a) that impacts on significant water resources, including surface and groundwater resources, are avoided, or are minimised to the greatest extent practicable,
 - (b) that impacts on threatened species and biodiversity, are avoided, or are minimised to the greatest extent practicable,
 - (c) that greenhouse gas emissions are minimised to the greatest extent practicable.
- (2) Without limiting subclause (1), in determining a development application for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider an assessment of the greenhouse gas emissions (including downstream emissions) of the development, and must do so having regard to any applicable State or national policies, programs or guidelines concerning greenhouse gas emissions.
- (3) Without limiting subclause (1), in determining a development application for development for the purposes of mining, the consent authority must consider any certification by the Chief Executive of the Office of Environment and Heritage or the Director-General of the Department of Primary Industries that measures to mitigate or offset the biodiversity impact of the proposed development will be adequate.

15 Resource recovery

- (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider the efficiency or otherwise of the development in terms of resource recovery.
- (2) Before granting consent for the development, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at optimising the efficiency of resource recovery and the reuse or recycling of material.
- (3) The consent authority may refuse to grant consent to development if it is not satisfied that the development will be carried out in such a way as to optimise the efficiency of recovery of minerals, petroleum or extractive materials and to minimise the creation of waste in association with the extraction, recovery or processing of minerals, petroleum or extractive materials.

16 Transport

- (1) Before granting consent for development for the purposes of mining or extractive industry that involves the transport of materials, the consent authority must consider whether or not the consent should be issued subject to conditions that do any one or more of the following:
 - (a) require that some or all of the transport of materials in connection with the development is not to be by public road,
 - (b) limit or preclude truck movements, in connection with the development, that occur on roads in residential areas or on roads near to schools,
 - (c) require the preparation and implementation, in relation to the development, of a code of conduct relating to the transport of materials on public roads.
- (2) If the consent authority considers that the development involves the transport of materials on a public road, the consent authority must, within 7 days after receiving the development application, provide a copy of the application to:
 - (a) each roads authority for the road, and
 - (b) the Roads and Traffic Authority (if it is not a roads authority for the road).

Note.

Section 7 of the [Roads Act 1993](#) specifies who the roads authority is for different types of roads. Some roads have more than one road authority.

- (3) The consent authority:
 - (a) must not determine the application until it has taken into consideration any submissions that it receives in response from any roads authority or the Roads and Traffic Authority within 21 days after they were provided with a copy of the application, and
 - (b) must provide them with a copy of the determination.
- (4) In circumstances where the consent authority is a roads authority for a public road to which subclause (2) applies, the references in subclauses (2) and (3) to a roads authority for that road do not include the consent authority.

17 Rehabilitation

- (1) Before granting consent for development for the purposes of mining, petroleum production or extractive industry, the consent authority must consider whether or not the consent should be issued subject to conditions aimed at ensuring the rehabilitation of land that will be affected by the development.
- (2) In particular, the consent authority must consider whether conditions of the consent should:
 - (a) require the preparation of a plan that identifies the proposed end use and landform of the land once rehabilitated, or
 - (b) require waste generated by the development or the rehabilitation to be dealt with appropriately, or
 - (c) require any soil contaminated as a result of the development to be remediated in accordance with relevant guidelines (including guidelines under clause 3 of Schedule 6 to the Act and the *Contaminated Land Management Act 1997*), or
 - (d) require steps to be taken to ensure that the state of the land, while being rehabilitated and at the completion of the rehabilitation, does not jeopardize public safety.

Table 5-1 identifies and discusses the relevant matters for consideration in assessment of the proposal as set out in Part 3 of the SEPP.

Clause	Detail	Analysis
Clause 12 – Compatibility of proposed extractive industry with other land uses	Compatibility with other land uses	Sand extraction has been undertaken within the general locality since 1990 (see Figure 5-1) with few known complaints from neighbouring landowners. The site is in a rural location. Surrounding land uses include low intensity rural farms, rural living and nature conservation. Adjoining land uses also include sand extraction and a place of public worship. Sand extraction is permissible in the zone. Modelling of noise and dust impacts on nearby receptors has been undertaken (see Chapters 7 and 8 and Appendices B and C). With the provision of mitigation measures, the proposed

		development can operate with acceptable levels of impact. The proposed sand extraction extension is not likely to have a significant impact on other land uses in the locality.
Clause 13	Compatibility of proposed development with mining, petroleum production or extractive industry	Figure 5-1 illustrates the location of existing adjacent sand extraction operations in the vicinity. The proposed sand extraction operation is compatible with existing sand extraction operations. No unacceptable cumulative impact (air quality, noise, traffic etc.) is anticipated as a result of the proposed sand extraction facility.
Clause 14 - Natural resource management and environmental management	Significant impacts on water resources	No significant impacts. Matters addressed in Chapter 13 and Appendix A.
	Impacts on Threatened Species	No significant impacts. Matters addressed in Chapter 9 and Appendix D.
	Greenhouse Gas Emissions	No significant impact. Greenhouse gas emissions will be limited to the emissions caused by front end loaders, sand removal trucks, site office and manager's residence construction equipment and by light vehicles associated with the operation of the site.
Clause 15 - Resource Recovery	Resource Recovery	Extraction of sand will involve the removal of windblown sand to ground level. The sand will be extracted and removed from the site in such a manner as to ensure that resource recovery is maximised and that there is minimal waste of resource.
Clause 16 - Transport	Transport	The proposed development will cause a marginal increase the truck movements along Nelson Bay Road. The capacity of the road has been assessed as being capable to accommodate the increase. There is no alternative to remove sand from the site other than via truck haulage. Traffic impacts are addressed in Chapter 12 and Appendix G.

Clause 17 Rehabilitation	– Rehabilitation	At the cessation of sand mining at the temporal conclusion of any development consent issued for the proposed development, site rehabilitation works (batter works including stable angle of repose) will be undertaken in accordance with the geotechnical requirements specified in Chapter 18 . The southern extent of the sand dune will be stabilised with relevant densities and types of spinifex grass species.
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Table 5-1: Matters for Consideration SEPP Mining, Petroleum Production & Extractive Industries 2007

SEPP (Rural Lands) 2008

The aims of this SEPP are:

- (a) to facilitate the orderly and economic use and development of rural lands for rural and related purposes,
- (b) to identify the Rural Planning Principles and the Rural Subdivision Principles so as to assist in the proper management, development and protection of rural lands for the purpose of promoting the social, economic and environmental welfare of the State,
- (c) to implement measures designed to reduce land use conflicts,
- (d) to identify State significant agricultural land for the purpose of ensuring the ongoing viability of agriculture on that land, having regard to social, economic and environmental considerations,
- (e) to amend provisions of other environmental planning instruments relating to concessional lots in rural subdivisions.

The rural planning principles stipulated by the SEPP are as follows:

- (a) the promotion and protection of opportunities for current and potential productive and sustainable economic activities in rural areas,
- (b) recognition of the importance of rural lands and agriculture and the changing nature of agriculture and of trends, demands and issues in agriculture in the area, region or State,

- (c) recognition of the significance of rural land uses to the State and rural communities, including the social and economic benefits of rural land use and development,
- (d) in planning for rural lands, to balance the social, economic and environmental interests of the community,
- (e) the identification and protection of natural resources, having regard to maintaining biodiversity, the protection of native vegetation, the importance of water resources and avoiding constrained land,
- (f) the provision of opportunities for rural lifestyle, settlement and housing that contribute to the social and economic welfare of rural communities,
- (g) the consideration of impacts on services and infrastructure and appropriate location when providing for rural housing,
- (h) ensuring consistency with any applicable regional strategy of the Department of Planning or any applicable local strategy endorsed by the Director-General.

The EIS demonstrates the ability of the proposed development to comply with the relevant aims and principles of the SEPP.

SEPP (Coastal Management) 2018

The aim of this SEPP is to *"promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area"*.

Pursuant to the SEPP, coastal management areas include:

- Coastal wetlands and littoral rainforest area;
- Coastal vulnerability area;
- Coastal environment area;
- Coastal use area.

The coastal management area relevant to the site is the *coastal environment area*. The *coastal environment area* is restricted to the part of the site south of the electrical easement (refer to **Figure 5-2** below) and essentially correlates with a part the area of the site which is intended for sand extraction purposes.



Figure 5-2: Coastal Environment Area Map and Relevance to Subject Land

Clause 13 (1) and (2) of the SEPP is relevant for the purposes of the proposed development of the land.

Clause 13 (1) states that consent must not be granted to development within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

- (a) the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,
- (b) coastal environmental values and natural coastal processes,
- (c) the water quality of the marine estate (within the meaning of the [Marine Estate Management Act 2014](#)), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,
- (d) marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,

- (e) existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,
- (f) Aboriginal cultural heritage, practices and places,
- (g) the use of the surf zone.

The relevant expert reports (located as Appendices to the EIS) clearly articulate that there are minor, limited impacts emanating from the proposed development of the land which are of relevance to subclause 13(1) and which can be managed in an acceptable way

Clause 13(2) stipulates that development consent must not be granted to development on land to which this clause applies unless the consent authority is satisfied that:

- a) the development is designed, sited and will be managed to avoid an adverse impact referred to in subclause (1), or
- b) if that impact cannot be reasonably avoided – the development is designed, sited and will be managed to minimise that impact, or
- c) if that impact cannot be minimised – the development will be managed to mitigate that impact.

The relevant reports have identified that there are minor impacts in the small area of the site the subject of the coastal environment area mapping and that these impacts can be managed in an acceptable manner consistent with the primary aim of the Coastal SEPP being to appropriately manage development in the coastal zone and protect the environmental assets of the coast.

SEPP 33 Hazardous and Offensive Development

SEPP 33 has the following aims:

- a) to amend the definitions of hazardous and offensive industries where used in environmental planning instruments, and
- b) to render ineffective a provision of any environmental planning instrument that prohibits development for the purpose of a storage facility on the ground that the facility is hazardous or offensive if it is not a hazardous or offensive storage establishment as defined in this Policy, and

- c) to require development consent for hazardous or offensive development proposed to be carried out in the Western Division, and
- d) to ensure that in determining whether a development is a hazardous or offensive industry, any measures proposed to be employed to reduce the impact of the development are taken into account, and
- e) to ensure that in considering any application to carry out potentially hazardous or offensive development, the consent authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact, and
- f) to require the advertising of applications to carry out any such development.

Definitions of "potentially hazardous industry" and "potentially offensive industry" are as follows:

"potentially hazardous industry means a development for the purposes of any industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would pose a significant risk in relation to the locality:

- a) *to human health, life or property, or*
- b) *to the biophysical environment,*

and includes a hazardous industry and a hazardous storage establishment".

"potentially offensive industry means a development for the purposes of an industry which, if the development were to operate without employing any measures (including, for example, isolation from existing or likely future development on other land) to reduce or minimise its impact in the locality or on the existing or likely future development on other land, would emit a polluting discharge (including for example, noise) in a manner which would have a significant adverse impact in the locality or on the existing or likely future development on other land, and includes an offensive industry and an offensive storage establishment".

The proposed development is not considered to be characterised by any of the above land use definitions.

Bushfire considerations, public safety and transport considerations (as detailed by SEARs under the heading of 'Hazards') have been appropriately considered under relevant chapters of the EIS.

SEPP 44 Koala Habitat Protection

The aims of SEPP 44 are: “to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline:

- (a) by requiring the preparation of plans of management before development consent can be granted in relation to areas of core koala habitat;
- (b) by encouraging the identification of areas of core koala habitat;
- (c) by encouraging the inclusion of areas of core koala habitat in environment protection zones.

State Environmental Planning Policy No.44 – Koala Habitat Protection (SEPP 44) applies to the proposed development.

The Port Stephens Comprehensive Koala Plan of Management (CKPoM) is an adopted Management Plan under the provisions of SEPP 44. Detailed reporting of the proposed development against the Port Stephens Comprehensive Koala Plan of Management is contained in **Chapter 9** and **Appendix D** of the EIS.

No Koalas nor Koala Feed Tree Species were present nor were any areas of Preferred Koala Habitat present within the site.

5.4 Port Stephens Local Environmental Plan 2013

The *Port Stephens Local Environmental Plan 2013* (PSLEP) is relevant to the subject site and the proposal. The PSLEP identifies the zoning of the land, the objectives of the land zoning, and specific requirements relating to the subject land and the proposal; the relevant parts and clause of the PSLEP are addressed below.

5.4.1 Land Zoning

The site is zoned RU2 – Rural Landscape (refer map/sheet LZN_005C in the PSLEP).

The zoning of the land is illustrated in **Figure 5-3**.

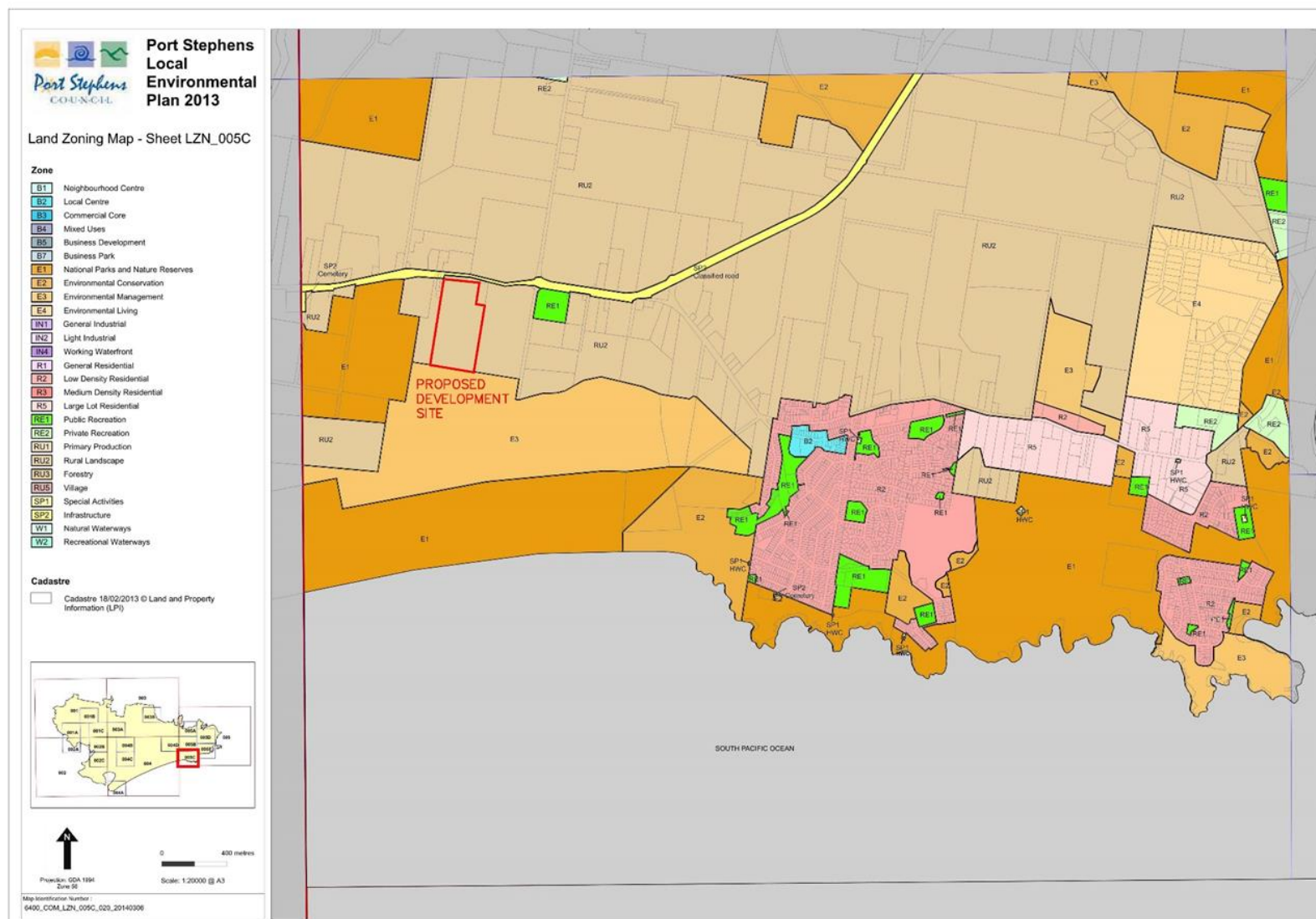


Figure 5-3: Port Stephens LEP 2013 Zoning Map

5.4.2 Land Zoning Objectives

The objectives of RU2 zoned land are:

- *To encourage sustainable primary industry production by maintaining and enhancing the natural resource base.*

Comment – Primary industries are those that harvest or extract raw material from nature, such as agriculture, oil and gas extraction, logging and forestry, mining and fishing. The proposed sand extraction is a primary industry. Ancillary development, being a site office and manager's residence, is proposed to support the primary industry. Sand is being continually replaced in this location due to demonstrated prevailing wind activity.

- *To maintain the rural landscape character of the land.*

Comment – The proposed sand extraction and associated site office/manager's residence is considered consistent with a rural landscape character.

- *To provide for a range of compatible land uses, including extensive agriculture.*

Comment – The proposal is considered to be compatible with surrounding rural land uses.

The proposal is consistent with all of the stated objectives of the RU2 – Rural Landscape zone within the PSLEP.

5.4.3 Permissibility

The proposed extraction and removal of sand from the site is defined as an extractive industry. PSLEP defines an extractive industry as:

“extractive industry means the winning or removal of extractive materials (otherwise than from a mine) by methods such as excavating, dredging, tunnelling or quarrying, including the storing, stockpiling or processing of extractive materials by methods such as recycling, washing, crushing, sawing or separating, but does not include turf farming”.

The proposed development also incorporates a Site Office and Manager's Residence.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

The proposed development is permissible with consent.

5.4.4 Other Relevant LEP Clauses

Clause 5.10 Heritage Conservation

The objectives of clause 5.10 are:

- (a) to conserve the environmental heritage of Port Stephens,
- (b) to conserve the heritage significance of heritage items and heritage conservation areas, including associated fabric, settings and views,
- (c) to conserve archaeological sites,
- (d) to conserve Aboriginal objects and Aboriginal places of heritage significance.

Due diligence and SEARs have required preparation of a Historic Heritage Assessment and an Aboriginal Cultural Heritage Assessment for the proposed development of the site. Both reports were prepared by Niche Environment and Heritage Consultants and are contained at **Appendices F and E** respectively.

The reports have each concluded that no direct or indirect impacts are likely to occur as a result of the proposed development.

Further details are contained at **Chapters 10 and 11** and **Appendices E and F**.

Clause 7.1: Acid Sulfate Soils

Clause 7.1 of the PSLEP relates to acid sulfate soils (ASS). The objective of this LEP clause is to ensure that development does not disturb, expose or drain acid sulfate soils and cause environmental damage.

The site has been identified on the relevant mapping as containing Class 4 ASS.

Clause 7.1 specifies that in relation to Class 4 ASS that development consent is required for works more than 2 metres below the natural ground surface and/or by works which are likely to lower the water table more than 2 metres below the natural ground surface.

The proposed sand extraction does not comprise works more than 2 metres below the natural ground surface: the proposed sand extraction only extends to the natural ground surface.

The proposal will not result in any lowering of the water table. The issue of ASS has been comprehensively addressed within the attached geotechnical report (see **Appendix A**). The geotechnical report advises that ASS are not an issue associated with the proposed development of the land.

Clause 7.2: Earthworks

Clause 7.2 of the PSLEP prescribes certain requirements for earthworks. This clause states that prior to the granting of consent, a consent authority must have considered the impact of the development on drainage patterns, soil stability, the effect of the development on the likely future use of the land, the quality of material to be extracted, the impact of the proposal on any adjoining lands, any likelihood of disturbing relics and proximity to and potential impacts on water sources or environmentally sensitive areas.

All of these matters have been duly assessed throughout relevant chapters of the EIS and it is considered that the proposal will have no adverse impacts in this regard.

Clause 7.6: Essential Services

Clause 7.6 of the PSLEP requires that development consent must not be granted to development unless the consent authority is satisfied that any of the following services that are essential for the development are available or that adequate arrangements have been made to make them available when required:

- (a) the supply of water,
- (b) the supply of electricity,
- (c) the disposal and management of sewage,
- (d) stormwater drainage or on-site conservation,
- (e) suitable vehicular access.

All services necessary to the proposed development are able to be provided.

5.5 Development Control Plan

The Development Control Plan relevant to this site and to the proposed development of the land is the *Port Stephens Development Control Plan 2014* (the PSDCP). The stated aim of the PSDCP is to facilitate development in accordance with the PSLEP. The relevant sections of the PSDCP are addressed below.

Part B2 Natural Resources

A Biodiversity Development Assessment Report (BDAR) has been prepared by Wildthing Environmental Consultants. The BDAR satisfies the requirements of Part B2 of PSDCP, including the need to address Council's Comprehensive Koala Plan of Management.

The Biodiversity Assessment Report, which details the impact of the proposed development and which includes recommendations for mitigation to biodiversity values, is discussed in detail at **Chapter 9**. A copy of the Biodiversity Assessment Report is located at **Appendix D**.

The direct biodiversity impacts arising from the project include:

- the removal of 0.22 ha of Vegetation Zone 1648_DNG
- the removal of 0.59 ha of Vegetation Zone 1648_Intact
- the removal of 0.11 ha of Vegetation Zone 1204_Sparse
- the potential removal of 2 hollow-bearing trees within Vegetation Zone 1648_Intact
- the removal of threatened species habitat, including the removal of 0.81 ha of suitable habitat for the species credit species Rough Doubletail Orchid.

Biodiversity impacts have been assessed through:

- Comprehensive mapping and assessment completed in accordance with recognised Biodiversity Assessment Methodology (BAM);
- The identification of a threatened species of flora within the development site, the impacts to which have been adequately assessed;
- Mitigation measures which have been outlined to reduce the impacts to biodiversity;
- The generation of 19 Ecosystem Credits within the development site for impacts to native vegetation and the generation of 14 Species Credits for impacts to the Rough Doubletail Orchid.

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by either:

- (a) retiring credits under the Biodiversity Offsets Scheme
- (b) making payments into the Biodiversity Conservation Fund
- (c) funding a biodiversity action

Part B3 Environmental Management

B3.A Acid Sulfate Soils

The site is mapped as containing Class 4 acid sulfate soils (ASS).

A geotechnical assessment was prepared by RCA, including testing for ASS. The assessment is located at **Appendix A** and associated further detail is provided at **Chapter 13**.

Based on the results of the ASS testing, the proposed development is not expected to encounter actual acid sulfate (AAS) nor potential acid sulfate soils (PASS).

B3.B Air Quality

An air quality assessment has been prepared for the proposed development (Advitech Environmental). The report concludes that the proposal is unlikely to result in adverse air quality impacts. The air quality assessment report is discussed at **Chapter 8** and a copy of the report is located at **Appendix C**.

B3.C Noise

An acoustic assessment has been prepared for the proposed development (Advitech Environmental). Noise predictions indicate that exceedances of the noise goals may be expected under some construction and operational conditions. However, through appropriate mitigation measures, such exceedances are able to be kept to a minimum.

The acoustic assessment report is discussed at **Chapter 7** and a copy of the report is located at **Appendix B**.

Part B4 Drainage and Water Quality

B4.A Stormwater Drainage Plan

Rainwater will be collected from the proposed site office/manager's residence and stored in rainwater tanks for re-use on site.

B4.B On-site Detention/On-site Infiltration

Rainwater from the proposed site office/manager's residence is to be captured in rainwater tanks for reuse on the site. The proposed increase in impermeable surface area is 0.61%. The proposed development will not result in the creation of any other impermeable surfaces.

Rainwater tanks will have a minimum capacity of 20,000 litres.

No stormwater will be directed to the public drainage system and any tank overflow will be dispersed via a level spreader for natural infiltration into this sandy site. This is considered acceptable and will result in no adverse impacts.

B4.C Water Quality

No runoff will be disposed of via the public drainage system. Given the minimal increase in runoff which is expected to eventuate from a 0.61% increase in impermeable area and the fact that this is to be captured rainwater tanks for re-use, it is considered that any rainwater overflow will be minimal and will not require treatment.

Part B6 Essential Services

B6.A Essential Services

The following essential services will be provided:

- Potable water supply will be made available from the collection of roof water from the site office/manager's residence into rainwater tanks;
- Effluent will be disposed of via an on-site effluent treatment system;
- Electricity will be provided via solar supply; and
- Telecommunications will be wireless.

Part B8 Heritage

Due diligence and SEARs have required preparation of an Historic Heritage Assessment and an Aboriginal Cultural Heritage Assessment for the proposed development of the site. Both reports were prepared by Niche Environment and Heritage Consultants and are contained at **Appendices E** and **F** respectively.

The reports have each concluded that no direct or indirect impacts are likely to occur as a result of the proposed development.

Further details are contained at **Chapters 10** and **11**.

Part B9 Road Network and Parking

B9.A Traffic Impacts

A traffic impact assessment has been prepared by Better Transport Futures (**Appendix G**) and further detail is provided at **Chapter 12**.

The report advises that both local road and intersection capacity are not unduly impacted by traffic generation associated with the proposed development.

A Basic Left Turn Treatment (BAL) is considered an appropriate measure for providing egress to Nelson Bay Road from the site.

B9.B On-Site Parking Provisions

Adequate on-site parking is available for the proposed development.

B9.C On-Site Parking Access

Ingress and egress from the site will be in a forward direction via one driveway. This access is directly from and onto Nelson Bay Road with left in and left out only provision.

This has been assessed in the traffic impact assessment and is considered acceptable.

Part B10 Social Impact

A Social Impact Assessment (SIA) has been prepared by Tattersall Lander Pty. Ltd. (**Appendix K**). The SIA concludes that the proposed development will not have a significant adverse impact on the locality nor on other stakeholders associated with the proposed development. The detail of the SIA is contained at **Chapter 17**.

Part C4 Dwelling House, Secondary Dwelling, Dual Occupancy or Ancillary Structures

C4.A Height

There is no prescribed maximum building height in this location. The height of the proposed site office/manager's residence is 6.5 metres. The height of the building is appropriate for the context and character of the area.

C4.B Setbacks

The front setback requirement is a minimum of 10 metres. The proposed site office/manager's residence building envelope is located approximately 39.5 metres from Nelson Bay Road.

The side setback requirement is a minimum of 5 metres. The proposed site office/manager's residence building envelope is located approximately 22.0 metres and 3.5 metres from the western and eastern side boundaries respectively.

The rear setback requirement is a minimum of 5 metres. The proposed site office/manager's residence building envelope is located approximately 11.1 metres from the rear boundary.

All setbacks are compliant with PSDCP requirements.

C4.C Streetscape and Privacy

The location and design of the site office/manager's residence is considered appropriate for a development of this nature. Privacy considerations are not an issue between properties, largely due to property size and existing and proposed building locations.

C4.D Private Open Space

Significant private open space exists on the property.

C4.E Car Parking and Garages

Undercover car parking will only be required for the manager of the site and will be accommodated within the proposed site office building/manager's residence.

C4.F Landscaping

The site is significantly vegetated to the extent that no additional landscaping is proposed or required. The vegetation which is to be removed for the site

office/manager's residence and its associated asset protection zone cannot be replaced with significant landscaping as this will result in an adverse impact on bush fire protection for the site.

C4.G Site Facilities and Services

A Waste Management Plan was prepared by Advitech Environmental (**Appendix H**).

The report advises that the quantity of waste generated by the proposed development can be adequately managed onsite and through the local Council waste collection services.

Adequate clothes drying facilities will be made available.

C4.H Ancillary Structures

The site office/manager's residence is considered as an ancillary structure.

DCP requirements are that ancillary structures are located a minimum of 10 metres from the side and rear boundaries and 5 metres from any other building. The proposed development is compliant with these requirements.

Construction colours will comprise neutral tones, consistent with the rural amenity of the location.

6 ENVIRONMENTAL IMPACT ASSESSMENT: WATER

An expert report addressing site geotechnical and groundwater characteristics and the impacts of the proposed development was undertaken by RCA Australia (**Appendix A**).

6.1 Existing Geotechnical and Water Environment

The ground surface level in the vicinity of the proposed development is variable. Away from the sand dunes, the existing ground surface across the site is gently undulating with slopes typically of the order of 0 to 5 degrees.

In the area of the electricity easement the ground surface has been modified and is roughly level at approximately RL 9mAHD. South of the electricity easement the ground surface levels rise abruptly at about 30 to 33 degrees up into the sand dunes to approximately RL17mAHD in the vicinity of the proposed sand extraction. Slopes on top of the sand dune system are variable with slopes typically in the order of 0 to 10 degrees with localised sand dune faces having slopes up to 30 degrees.

Drainage across the site comprises infiltration drainage in the permeable sand. Surface water infiltration testing yielded infiltration rates which varied from 4 to 5x10⁴m/sec. Soils beneath the site comprise a quartzose aeolian sand profile.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource which falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. The sand aquifer extends from the mouth of the Hunter River in the south to Anna Bay in the north and is bounded by the Newcastle Bight/Tasman Sea in the east and the Tilligerry Creek estuary and flood plains in the west. The groundwater beneath the coastal dune system forms a groundwater divide between the ocean and Tilligerry Creek. Groundwater recharge is primarily from rainfall infiltrating the dune system and discharges by evapotranspiration and from groundwater discharge down gradient to the ocean and tidal estuary/ floodplain drains.

Ground water was encountered at a depth corresponded to a level of approximately 2m AHD. Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand extraction during extreme wet climatic periods.

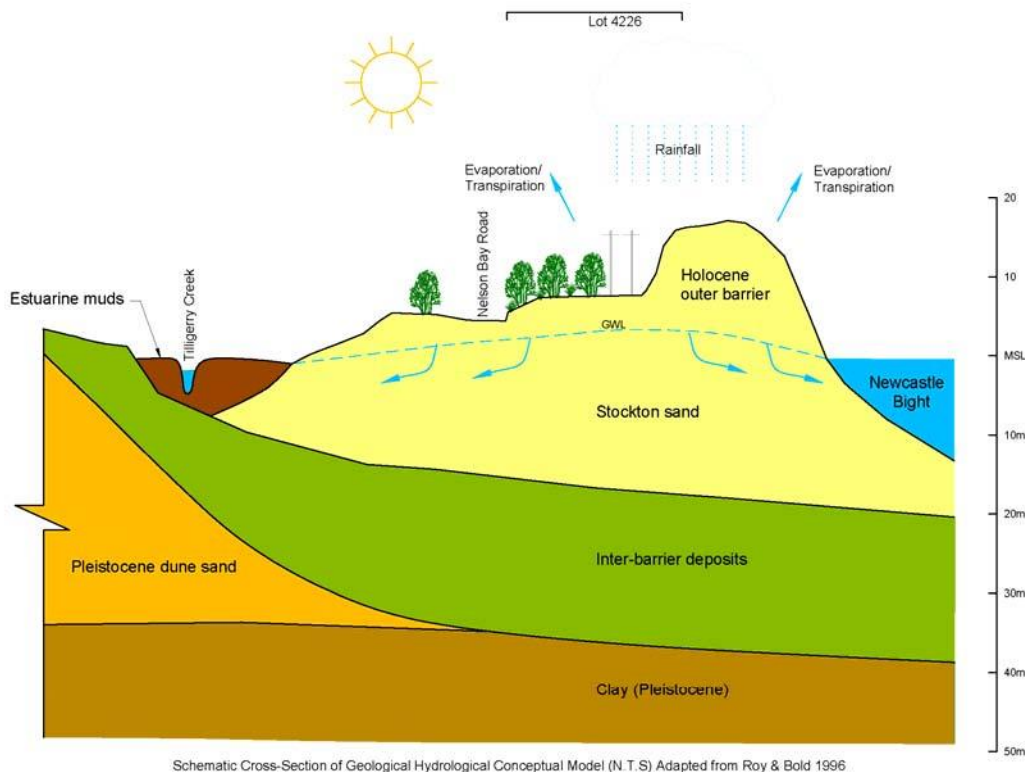


Figure 6-1: Schematic Cross-section of Geological/Hydrogeological Site Characteristics

6.2 The Proposal

The proposed sand extraction operation will remove windblown sand to ground level only. Site groundwater will be a minimum of 2.8m below the base of the extraction operations.

The proposal also includes ancillary development comprising a site office/manager's residence. Rainwater from the roof area of this building will be captured in rainwater tanks with a minimum 20,000 litre capacity for reuse on site. Any water overflow from the rainwater tanks will be dispersed via a level spreader.

6.3 Potential Impacts

The sand extraction operations and the proposed site office/manager's residence will not intercept groundwater.

Any water overflow from the rainwater tanks will be dispersed via a level spreader and will have an insignificant impact on the water characteristics of the site and its catchment.

The potential for accidental fuel or oil spillage is recognised and, should it occur, may impact groundwater. Particular amelioration controls are envisaged in this regard, as detailed below.

6.4 Mitigation Measures

In order to minimise the possibility of groundwater contamination, all refuelling and minor servicing of equipment used in these operations will be undertaken within the site office structure on an impervious surface. The proposed size and scope of this building will enable this to occur.

Additionally, all fuels, oils, or other chemicals are to be stored within this building in an appropriately bunded area. All vehicles/machinery on site will be adequately and appropriately serviced to minimise the incidence of fuel and oil leaks occurring. A fuel spill kit will be kept on site at all times.

It is envisaged that the likelihood of any impact on groundwater is extremely low. Mitigation measures proposed are adequate for the purposes of the development.

7 ENVIRONMENTAL IMPACT ASSESSMENT: NOISE

An acoustic impact assessment has been prepared (Advitech Environmental) to establish the acoustic impacts associated with the proposed development.

A copy of the acoustic impact assessment is located at **Appendix B**.

7.1 Sensitive Receivers and Existing Acoustic Environment

The closest receivers to the proposed development site include the Baylife Church on the property immediately to the east of the site and residential receivers adjacent to Nelson Bay Road. The Worimi National Park is located to the west of the site, and the Birubi Beach foreshore is about 1 kilometre to the south of the extent of the proposed development. There are commercial facilities, including a nursery and a service station about 700 metres to the east and the west of the site respectively. A showground and the Nelson Bay Pony Club are located east of the site. There are also three (3) existing sand extraction quarries to the east of the proposed development site. **Figure 7-1** shows the surrounding land uses.

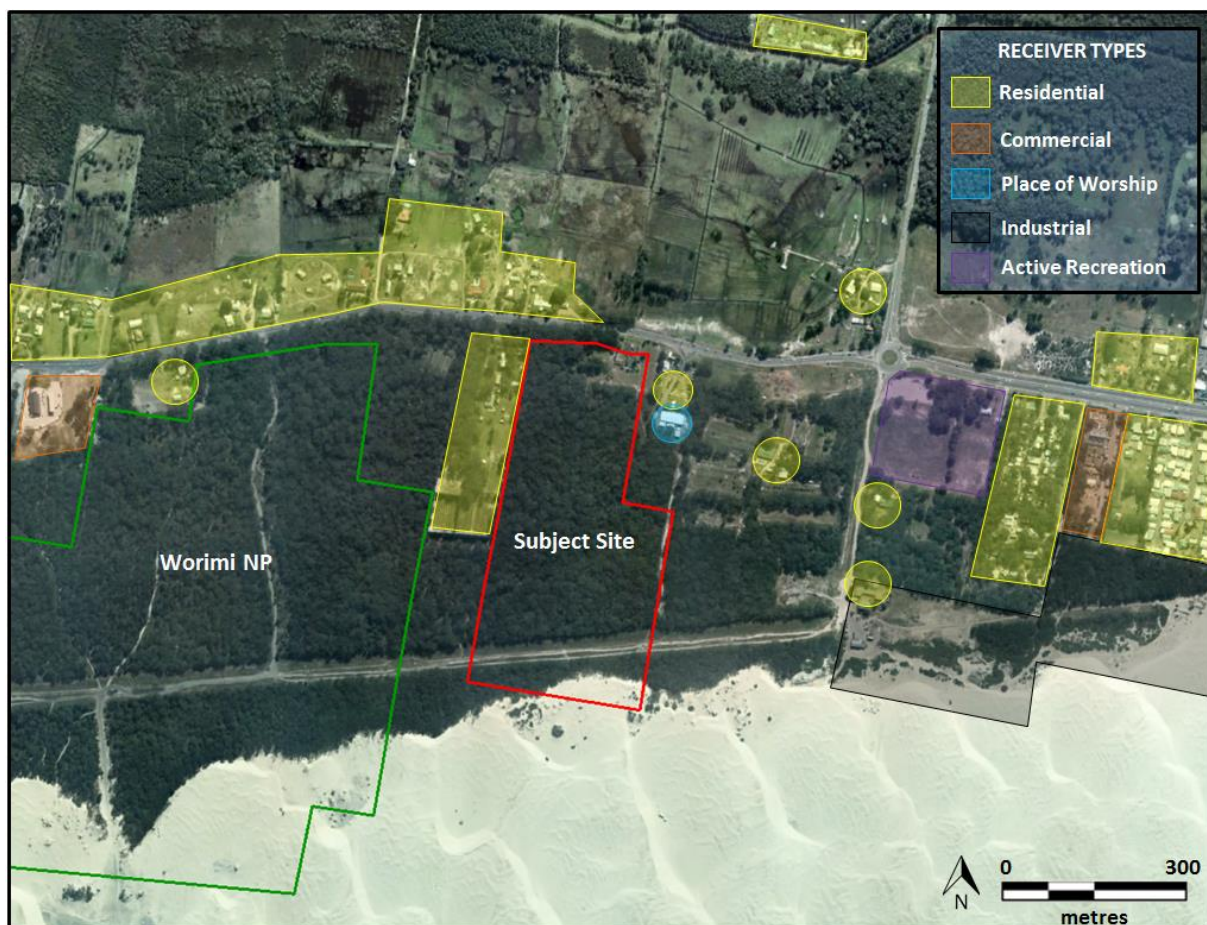


Figure 7-1: Sensitive land use types within noise impact study area

(Source: Advitech Environmental, 2018)

Site inspection and review of aerial imagery indicate that the proposed development site is generally rural in nature; however, the site has frontage to Nelson Bay Road with characteristically heavy and continuous traffic flows during peak periods. Two distinct sensitive receiving environments adjacent to the proposed development site were identified, including: 1. receivers immediately adjacent to Nelson Bay Road (generally with frontage or shared boundary with the roadway); and 2. receivers setback from Nelson Bay Road (with or without frontage to Nelson Bay Road);

A combination of unattended background monitoring and short-term operator attended noise monitoring was undertaken in each of these receiving environments to characterise existing noise levels. These data were used to derive the Project Specific Noise Level (PSNL) for the development. As heavy and continuous through traffic was observed to be a feature of the locality, all receiving environments were characterised as representative of the Urban Residential receiver type established in the Industrial Noise Policy (EPA, 2000) (INP).

7.1.1 Assessment of Existing Noise Levels

Environmental noise monitoring was undertaken at two locations to measure ambient and background noise levels in receiving environments adjacent to the proposed development site (**Figure 7-2**). The monitoring locations were selected such as to be representative of typical receiver locations in these receiving environments.

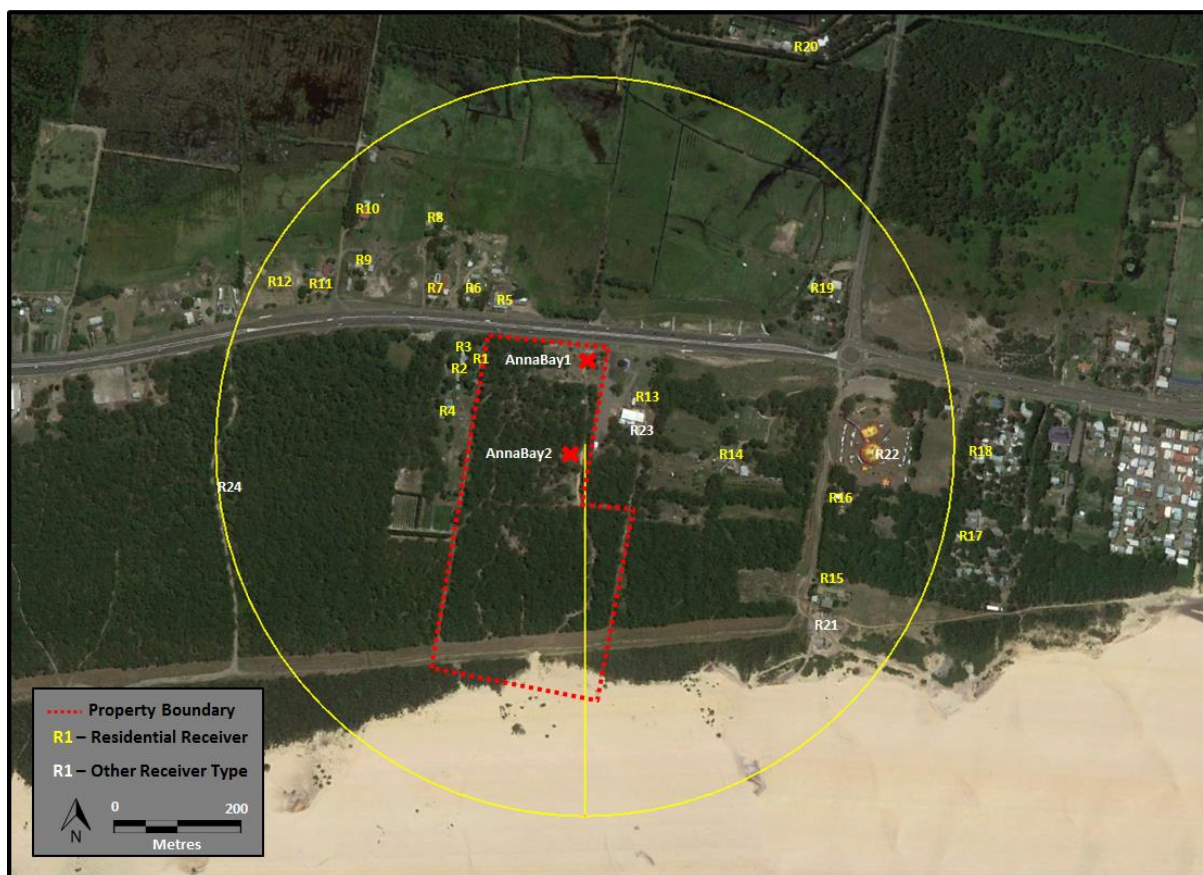


Figure 7-2: Sensitive receivers and noise monitoring locations

(Source: Advitech Environmental, 2018)

The noise monitoring was carried out using two ARL-EL-316 Type 1 Environmental Noise Loggers. The logger calibrations were checked before and after the measurement period, with no significant drift (± 0.5 dB) noted. Details relevant to the background noise monitoring are provided in **Table 7-1**.

Table 7-1: Details of background monitoring

Location	Adjacent to Nelson Bay Road (RecEnv1)	Setback Receivers (RecEnv2)
Logger Serial Number	ARL316 (s/n:16-203-513)	ARL316 (s/n:16-299-450)
Measurement Title	AnnaBay1	AnnaBay2
Run Started	1/02/18 14:00	1/02/18 14:00
Run Stopped	14/02/18 13:30	14/02/18 13:30
Frequency Weighting	A	A
Time Response	Fast	Fast
Engineering Units	dB SPL	dB SPL

(Source: Advitech Environmental, 2018)

The noise levels obtained from the continuous noise logging (presented graphically in Appendix I of the Advitech Environmental Report) are expressed in terms of, $LA_{90,15\text{minute}}$ and $LA_{eq,15\text{minute}}$.

($LA_{90,15\text{minute}}$ is the A-weighted noise level that is exceeded for 90% of the monitoring time period (15 minutes). The $LA_{eq,15\text{minute}}$ is the 15-minute equivalent continuous noise level containing the same acoustic energy as the actual fluctuating noise level.

The $LA_{90,15\text{minute}}$ descriptor is commonly referred to as the background noise level and the lowest 10th percentile $LA_{90,15\text{minute}}$ over a period (day, evening, night) is referred to as the period assessment background level (ABL). The Rating Background Level (RBL) for each assessment period of the monitoring occurrence is then calculated by taking the median of the ABLs).

Supplementary local meteorological monitoring (rain, wind speed and direction) was undertaken using a Davis Vantage Vue Precision Weather Station at the monitoring location set back from Nelson Bay Road (AnnaBay2). This data is used to validate noise monitoring results in accordance with provisions established in Section 5 of the INP.

7.1.2 Noise Monitoring Results

The Rating Background Level (RBL) and associated Intrusiveness Criteria were determined for the receiving environments adjacent to the proposed development in accordance with provisions established in the INP. The results of this analysis are presented in **Table 7-2**.

Table 7-2: Details of background monitoring (Day period 7:00 to 6:00pm)

Adjacent to NBR (AnnaBay1)		Setback Receivers (AnnaBay2)
Date	Day	Day
1/02/2018	-	-
2/02/2018	51	46
3/02/2018	50	47
4/02/2018	49	45
5/02/2018	-	-
6/02/2018	48	43
7/02/2018	50	43
8/02/2018	49	44
9/02/2018	51	43
10/02/2018	47	41
11/02/2018	43	39

Adjacent to NBR (AnnaBay1)		Setback Receivers (AnnaBay2)
Date	Day	Day
12/02/2018	49	42
13/02/2018	49	44
14/02/2018	47	40
Rating		
Background Level (RBL)	49	43
Mean LAeq	60	54

(Source: Advitech Environmental, 2018)

Assessment of monitoring results is presented for the day period (7:00 to 6:00pm) only, as the development is not proposed to operate during the evening or night periods. Periods for which Assessment Background Levels (ABL) are not presented were omitted from the analysis based on the data exclusion rules outlined in Appendix B of the INP.

Short term attended monitoring was also undertaken at each of the monitoring locations on 1 February, 2018 during the day period, as a means of characterising the ambient noise sources within the receiving environments. The attended monitoring was undertaken using a Svantek (SVAN) 958, Type 1 sound level meter (SLM) (S/N:20777), with the results of the monitoring detailed in **Table 7-3**.

Table 7-3: Attended Monitoring Results, dB(A)

Location	Date	Time	LA10	LAeq	LA90	Comments
AnnaBay1 (Adjacent to NBR)	1/02/18	12:57	58	55	51	Bird Chatter up to 73 dB(A) Road Noise up to 60 dB(A)
AnnaBay2 (Setback Receivers)	1/02/18	12:23	57	54	50	Bird Chatter up to 65 dB(A) Road Noise up to 69 dB(A)

(Source: Advitech Environmental, 2018)

Existing industrial facilities within the locality of the study site, including other sand mining operations, were not audible at any time during the attended noise monitoring events.

7.1.3 Assessment of Prevailing Meteorology

The INP identifies that meteorological conditions such as wind gradients and temperature inversions may enhance noise propagation from industrial sites to distant sensitive receivers. The guide provides two options for the assessment of these impacts:

- a) a simple method, which adopts worst case noise enhancing conditions; and
- b) a more detailed analysis of prevailing meteorology, to identify whether enhancing conditions occur with sufficient frequency to be considered a feature of the local environment:
 - where enhancing conditions occur with sufficient frequency, noise enhancing meteorological parameters should be adopted by the noise modelling;
 - where enhancing conditions are not a feature of the environment, modelling should adopt the standard meteorological parameters.

The INP sets the threshold of significance at 30% of the time during any assessment period, assessed seasonally.

The nearest Bureau of Meteorology (BoM) Automatic Weather Station (AWS) is located at Nelson Bay, approximately 11km northeast of the proposed development site. Monthly climate statistics between 1968 and 2010 were analysed to identify whether any prevailing wind patterns may be considered a feature of this environment. Wind is considered to be a feature of the environment where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time of more in any assessment period, in any season.

The results of the analysis of monthly climate statistics indicated that prevailing winds were not observed for more than 30% of the time during any season. Prevailing winds are therefore not considered a significant feature of this environment, and neutral meteorological conditions were applied to the assessment of noise propagation.

As temperature inversions are usually only prominent during sunset and sunrise, there is no need to consider their effect for a development that does not operate at night. Therefore, temperature inversions have not been considered within the noise assessment.

7.2 The Proposal

The proposed sand extraction will require the use of heavy vehicles and machinery, including front end loaders, truck and dog, and occasional mulchers. The

development is proposed to operate between the hours of 7:00am and 6:00pm Monday to Friday, and 8:00am to 1:00pm Saturdays.

The construction period for the proposed site office/manager's residence is anticipated to take approximately one to two months, with construction activities being undertaken during weekdays from 7:00am to 6:00pm.

7.3 Potential Noise Impacts

7.3.1 Noise Level Predictions: Construction Phase

A summary of predicted $L_{Aeq,15\text{minute}}$ noise levels at the nearest sensitive receivers associated with each of the construction phase scenarios are provided in **Table 7-4**. The predicted results are summarised by receiver type. Noise level contours for each of the construction phase scenarios are provided in Appendix II of the Advitech Environmental report.

Table 7-4: Worst case noise impact predictions (LAeq,15minute dB(A))

Scenario	Receiver Type	ID of most Affected Receiver	Prediction LAeq,15minute	NML LAeq,15minute	Count Receivers > NML
Vegetation Removal Including Mulching	Residential	R13	52	53-59	0
	Church	R23	42 ¹	45 (internal)	0
	Recreation	R22	47	60-65	0
	Industrial	R21	52	75	0
Haul Road Widening and Improvements	Residential	R13	67	53-59	2 (R13, R14)
	Church	R23	55 ¹	45 (internal)	1 (R23)
	Recreation	R22	48	60-65	0
	Industrial	R21	46	75	0
Site Preparation	Residential	R13	46	53-59	0
	Church	R23	36 ¹	45 (internal)	0
	Recreation	R22/R24	39	60-65	0
	Industrial	R21	42	75	0
Concrete Foundations	Residential	R13	46	53-59	0
	Church	R23	36 ¹	45 (internal)	0
	Recreation	R22/R24	37	60-65	0
	Industrial	R21	40	75	0
Shed Construction	Residential	R14	42	53-59	0
	Church	R23	32 ¹	45 (internal)	0
	Recreation	R22/R24	37	60-65	0
	Industrial	R21	41	75	0
Formation Widening	Residential	R13	64	53-59	3 (R5, R13, R14)
	Church	R23	51 ¹	45 (internal)	1 (R23)
	Recreation	R22	50	60-65	0
	Industrial	R21	46	75	0
Paving Works	Residential	R13	64	53-59	5 (R1, R5, R8, R13, R14)
	Church	R23	51 ¹	45 (internal)	1 (R23)
	Recreation	R22	51	60-65	0
	Industrial	R21	48	75	0

Note 1: Denotes predicted internal noise level

(Source: Advitech Environmental, 2018)

The results of noise modelling for site preparation and construction works indicate that:

- during haul road widening works, exceedances of the day period NML may be expected for:
 - (v) two residential receivers, R13 (14 dB) and R14 (2 dB);
 - (vi) one place of worship (R23) with predicted internal noise levels 10 dB above the NML;
- there were no receivers predicted to experience noise levels above the highly affected NML of 75 dB(A); and
- emissions associated with vegetation removal, site preparation, foundation works and shed construction are expected to be below the relevant NMLs at all receiver locations.

During site access construction works, involving the widening of Nelson Bay Road to allow a left turn lane into the proposed facility, and road paving works, the results of the modelling indicate that:

- three residential receivers would potentially experience noise levels, during formation widening works, that exceed the day period NMLs by up to 11 dB at R13, and up to 2 dB at R5 and R14;
- five residential receivers would potentially experience noise levels, during paving works, that exceed the day period NMLs by up to 11 dB at R13; 3 dB at R5 and R14; and 1 dB at R1 and R8;
- an exceedance of the internal NML, for a place of worship, was predicted of up to 7 dB at R23 (Baylife Church); and
- there were no predicted exceedances of the NML for recreation or industrial receivers.

The predicted noise levels represent conservative assumptions, based on all plant operating at maximum capacity, and at locations most exposed to the nearby sensitive receivers. Where plant do not work simultaneously and are not at their closest point, lower noise levels would be expected. It is therefore considered that these modelled predictions represent the absolute upper limit of expected noise levels.

It should be noted that many of the items of plant proposed for the construction phase activities have the potential to generate tonal influences, particularly in the case of reverse alarms. Where tonal reverse alarms are used in lieu of broadband reverse alarms, the predicted noise levels are expected to be up to 5 dB higher than those modelled.

7.3.2 Noise Level Predictions: Operational Phase

A summary of predicted $L_{Aeq,15\text{minute}}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios are provided in **Table 7-5**. The predicted results are summarised by receiver type. Noise level contours for each of the operational stage scenarios are provided in Appendix II of the Advitech Environmental report.

Table 7-5: Worst case noise impact predictions ($L_{Aeq,15\text{minute}}$ dB(A))

Scenario	Receiving Environment	ID	Prediction $L_{Aeq,15\text{minute}}$	PSNL $L_{Aeq,15\text{minute}}$	Count Receivers > PSNL
Quarry Operations (Front End Loader and Truck & Dogs)	Residential	R13	49	48-53	1 (R13)
	Church	R23	39 ¹	40 (internal)	0
	Recreation	R22	40	50-55	0
	Industrial	R21	43	70	0
Quarry Operations including Vegetation Mulching	Residential	R13	51	48-53	3 (R4, R13, R14)
	Church	R23	42	40 (internal)	1 (R23)
	Recreation	R22	45	50-55	0
	Industrial	R21	49	70	0

(Source: Advitech Environmental, 2018)

The results of noise modelling indicate that:

- a marginal exceedance of up to 1 dB above the day period criterion may be expected at residential receiver location R13 during general quarry operations;
- exceedances of 1 to 3 dB above the day period criterion may be expected at residential receivers R4, R13 and R14 during vegetation mulching activities, where they occur concurrently with general quarry operations; and
- an exceedance of up to 2 dB above the day period criterion for internal noise at a place of worship may be expected at the Baylife Church (R23), where vegetation mulching and general quarry operations are occurring concurrently.

The results of the noise modelling indicate that the movement of vehicles on the internal haul road is the predominant activity contributing to the marginal exceedance of the day period criterion at residential receiver location R13 during

general quarrying operations. In the absence of truck movements along the haul road, sand extraction activities are predicted to comply with the noise goals at each of the sensitive receiver locations.

During vegetation mulching activities, noise levels are predicted to increase at each of the receiver locations, with exceedances expected at three residential receivers (R4, R13 and R14), and the Baylife Church. It is noted that vegetation mulching activities would be an occasional practice at the site, occurring only when vegetation is uncovered from within the sand resource during quarrying operations.

7.3.3 Noise Level Predictions: Road Traffic Noise Assessment

Project generated traffic has the potential to increase noise levels on existing public roads. For sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise levels should be limited to 2 dB above that of the corresponding 'no build option'.

Vehicle movements would be determined by easement maintenance requirements, product demand and the availability of the resource. The ongoing annual volume of sand to be extracted is likely to be less than the maximum threshold extraction rate of 50,000 cubic metres per year. Notwithstanding this, the road traffic assessment has assumed a maximum number of vehicle movements based on the threshold production rate. The road traffic noise assessment was based on the following parameters:

- an assumed maximum of 4 heavy vehicles accessing and exiting the site per hour (this figure was established by dividing the maximum number of production vehicles per day (40) by the operating hours in each day (10 hours));
- it is anticipated that there would be a 75% / 25% split of vehicles accessing and departing the site via Nelson Bay Road from the west / east respectively; and
- the sign posted speed limit on Nelson Bay Road is 90km/h.

It is anticipated that one additional vehicle movement would occur per hour in and out of the site, which would account for light vehicle movements, delivery of goods and removal of waste.

Nelson Bay Road is the main arterial link connecting Newcastle to Williamstown and the Tomaree Peninsula. It carries a large volume of local and tourist traffic visiting the Nelson Bay area. It is the only route servicing the Tomaree Peninsula and the various townships between Newcastle and Nelson Bay. Based on a traffic survey undertaken by Trans Traffic Survey between 6 February 2018 and

13 February 2018, the existing traffic volumes on Nelson Bay Road are approximately 19,100 vehicles per day, with approximately 6% heavy vehicles.

As Nelson Bay Road is the main arterial road servicing the Tomaree Peninsula, carrying a high volume of existing traffic including heavy vehicles, it is expected that the maximum traffic generated by the proposed development would be less than 0.5% of AADT.

Typically, an increase in traffic noise level above the 2 dB increase criteria is expected where traffic volumes increase by 20% or more. Since the project is expected to increase traffic by a much lower amount than this, it is considered to comply with the RNP relative increase criteria. Therefore, it is considered that no significant increase of road traffic noise is expected on Nelson Bay Road as a result of the proposal.

7.4 Noise Mitigation Measures

7.4.1 Construction Phase

Noise impacts would be minimised during the construction phase of the proposal by implementing universal work practices.

In light of the predicted exceedances at nearby residential receivers and the Baylife Church under specific construction scenarios, noise mitigation and management measures will be implemented.

Methods for managing the potential impacts will include:

- early and ongoing communication with potentially affected receivers to inform of the proposed works, duration and potential for noise;
- training workers to minimise noise by avoiding shouting; minimising slamming vehicle doors; avoiding the use of radios or stereos outdoors where neighbours can be affected;
- keeping truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices;
- avoiding operating equipment simultaneously, where possible. This has the potential to substantially reduce noise emissions;
- designing of the site to avoid the use of reverse alarms or employ the use of broadband alarms to reduce the occurrence of any annoying characteristics;
- regular inspection and maintenance of equipment to ensure it is good working order;

- placing as much distance possible between plant or equipment and other sensitive land uses; and
- scheduling works to occur when neighbours are not present, or during times of high background noise to provide masking or reduce the amount that the construction noise intrudes above the background.

Although noise exceedances may be expected under haul road widening and turning lane improvement works, the activity will occur only for a relatively short term, and impacts will be minimised through the implementation of the above measures.

Where noise complaints are received during the construction period, noise monitoring may be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.

7.4.2 Operational Phase

In addition to universal work practices to minimise the site generated noise, the following noise control recommendations are provided to minimise noise emissions during the operational phase of the proposal:

- during sand extraction operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day;
- vegetation mulching is undertaken during periods of higher background noise levels, identified as the periods before 8:00am and after 3:00 pm.
- temporary barriers or local topography may be used to maximise the shielding of the nearby sensitive receivers from vegetation mulching activities.

Upon implementation of the noise mitigation and management measures, noise monitoring is to be carried out to establish the noise emission level of the facility at sensitive receivers and determine compliance. It is recommended that noise monitoring is undertaken on a quarterly basis for the facility's first year of operation, with the frequency of noise monitoring reviewed each year afterwards.

Monitoring should also be carried out in response to a complaint and should be completed as soon as practically possible after the complaint. Where applicable, following any corrective action, monitoring should be repeated to confirm the effectiveness of any control measure implemented.

It is considered that with the appropriate management of the site, noise impacts will be kept to a minimum.

8 ENVIRONMENTAL IMPACT ASSESSMENT: AIR QUALITY

An air quality impact assessment has been prepared (Advitech Environmental) to establish the air quality impacts associated with the proposed development.

A copy of the air quality impact assessment is located at **Appendix C**.

8.1 Sensitive Receivers and Existing Air Quality Environment

A number of potentially affected receivers were identified in the vicinity of the project site. These are shown in

Figure 8-1 and **Table 8-1**.

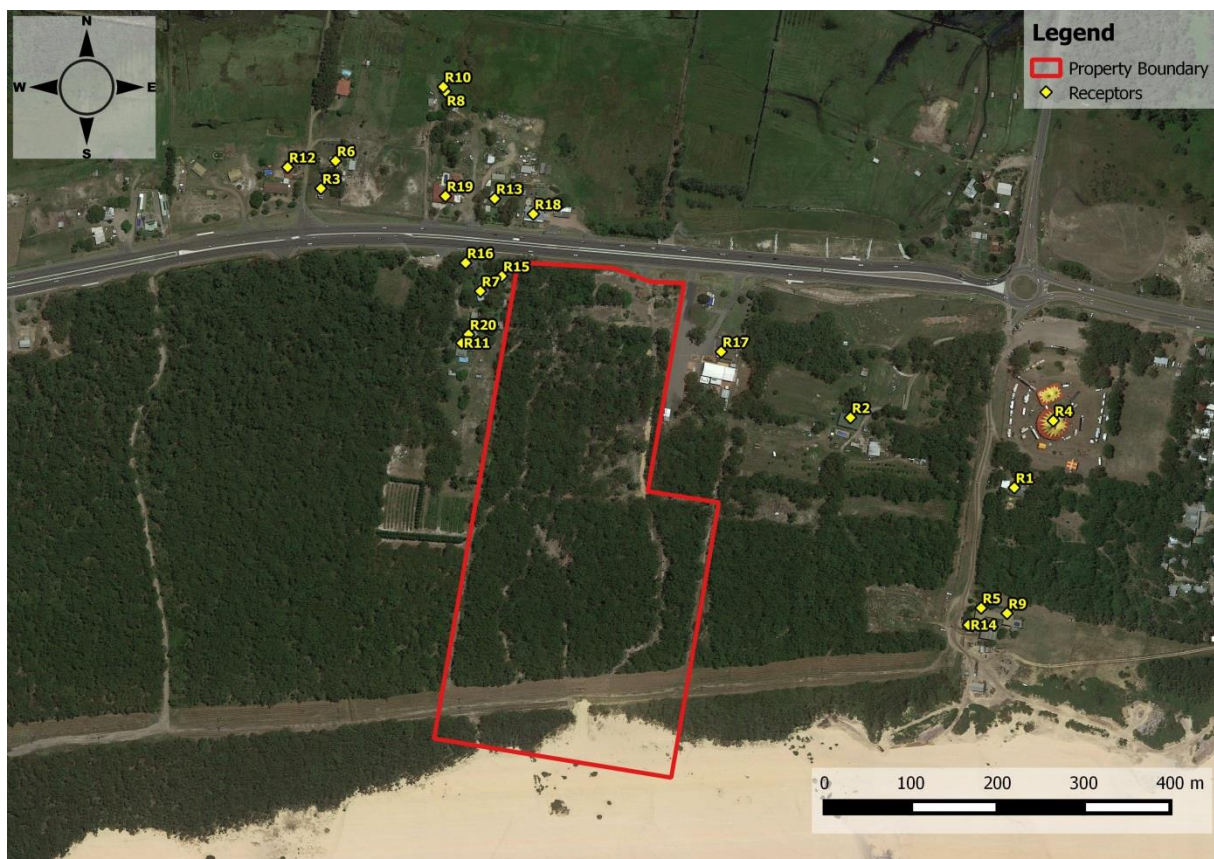


Figure 8-1: Sensitive Receivers

(Source: Advitech Environmental)

Table 8-1: Sensitive Receivers

Receiver ID	Easting (m)	Northing (m)	Address
R1	412483	6373710	6 Jessie Road, Anna Bay
R2	412293	6373789	5 Jessie Road, Anna Bay
R3	411678	6374047	4187 Nelson Bay Road, Anna Bay
R4	412528	6373787	2 Jessie Road, Anna Bay
R5	412446	6373571	Unit 2, 10 Jessie Road, Anna Bay
R6	411695	6374079	4199 Nelson Bay Road, Anna Bay
R7	411864	6373931	4208 Nelson Bay Road, Anna Bay
R8	411821	6374160	4199B Nelson Bay Road, Anna Bay
R9	412476	6373565	Unit 1, 10 Jessie Road, Anna Bay
R10	411819	6374165	4199A Nelson Bay Road, Anna Bay
R11	411843	6373871	Unit 2, 4206 Nelson Bay Road, Anna Bay
R12	411640	6374071	4181 Nelson Bay Road, Anna Bay
R13	411879	6374037	4205 Nelson Bay Road, Anna Bay
R14	412432	6373552	10 Jessie Road, Anna Bay
R15	411888	6373948	4210 Nelson Bay Road, Anna Bay
R16	411846	6373963	4206A Nelson Bay Road, Anna Bay
R17	412143	6373863	4236 Nelson Bay Road, Anna Bay
R18	411924	6374020	4213 Nelson Bay Road, Anna Bay
R19	411822	6374040	4201 Nelson Bay Road, Anna Bay
R20	411851	6373881	4206 Nelson Bay Road, Anna Bay

(Source: Advitech Environmental)

8.1.1 Background Air Quality

Assessment of background air quality data has been undertaken for the airshed in the vicinity of the proposed sand extraction operation.

The Biodiversity and Conservation Division, Department of Planning, Industry and Environment operates an air quality monitoring program that collects accurate real-time measurements of ambient level pollutants at 28 monitoring sites within the air quality monitoring network (AQMN), located around the greater metropolitan area of Sydney, the Illawarra, the Lower Hunter and selected rural sites around NSW. The monitoring location that is considered to be most representative of the Anna Bay area with data from the representative year is located at Beresfield approximately 20 kilometres to the west of the proposed development.

The Beresfield monitoring station commenced operation in 1998 and provides data on the following air quality parameters.

Ozone;

Particulates;

NO, NO₂, NO_x; and

SO₂.

A Level 1 assessment of background concentrations was prepared for the pollutants listed in **Table 8-2** for the 2010 monitoring year to correspond with meteorological data. The Level 1 assessment has assumed a worst-case background concentration by using the maximum reported value.

Table 8-2: Background Air Quality

Pollutant	Background Concentration ^a	Units	Averaging Time
TSP	33.2	µg/m ³	Annual
Dust Deposition	na	g/m ² /month	Annual
PM ₁₀	Variable (refer to Figure 4 Advitech Report)	µg/m ³	24 Hours
	16.6	µg/m ³	Annual
PM _{2.5}	Variable (refer to Figure 4 Advitech Report)	µg/m ³	24 Hours
	6.0	µg/m ³	Annual

^a Reported value is the average 24 hour result

^b Assumed from annual average PM₁₀ background (TSP = 2 x PM₁₀)

na - Not available

(Source: Advitech Environmental)

The maximum reported particulate matter, PM₁₀ and PM_{2.5} background concentration for the 2010 monitoring period was 50.0 and 25.9 µg/m³ respectively, which is above the departmental impact assessment criteria. As such, a Level 2 or contemporaneous assessment of the PM₁₀ and PM_{2.5} background concentration was undertaken to understand the cumulative impact of the proposed development. Further details are contained within the Advitech Environmental report located at **Appendix B**.

8.2 The Proposal

The activities associated with the proposed operations with the potential to generate dust are:

- Operation of front-end loaders within the extraction area;
- Loading by front-end loaders to the haul trucks; and
- Dust generated by haul truck movements within the excavation area.

Details of each emission source are given in **Table 8-3**. The emission factors and estimates are based on Emission Estimation Technique (EET) Manual for Mining - Version 3.1. Emissions from the manual are based on typical emission for coal and metalliferous mining operations. The emission factors have been applied to the sand quarry operation and can be considered as a conservative estimate.

Table 8-3: Modelled Emission Sources

Emitter Identifier	Emitter Name	Emission Factor			Modelled days (Days)	Modelled Working hours (hours/day)	Emission Rate(g/s)			Modelled Location		
		TSP	PM ₁₀	Units			TSP	PM ₁₀	PM _{2.5}	Easting (m)	Northing (m)	Ground Elevation (m)
FEL	Front end loader	0.00015	0.000071	kg/t	365	10	0.00586	0.00277	0.00042	411981	6373452	10
Load	Loading of sand into haul trucks	0.00015	0.000071	kg/t	365	10	0.00586	0.00277	0.00042	412017	6373495	11
HR1-HR21	Wheel generated dust from truck movements ¹	2.2430	0.598	kg/VKT	365	10	0.121	0.032	0.0032	Varies	Varies	Varies

Notes:

¹ – Kilometres travelled by haul trucks estimated from Google Earth satellite imagery and allowing for four loads per hour. Wheel generated dust from haul trucks within the sand quarry site were modelled as a volume source in CALPUFF. Each volume source has a separation distance of 25 metres.

(Source: Advitech Environmental)

8.3 Potential Air Quality Impacts

8.3.1 Sand Extraction

The particulate dispersion modelling indicates that air quality impacts (i.e. airborne dust and dust deposition) from the sand quarry will be low and there will be no exceedances of the PM₁₀, PM_{2.5} and TSP impact assessment criteria at sensitive receivers as a result of quarrying activities.

Any exceedances that may occur will be likely attributed to elevated background concentrations rather than any emissions from the sand quarry.

The maximum increase in dust deposition impact assessment criteria of 2 g/m²/month is predicted to be exceeded at one sensitive receiver (i.e. R17). However, the modelling scenario utilised by Advitech Environmental is considered to be very conservative and normal operations are unlikely to exceed the impact assessment criteria.

8.3.2 Construction Works

Potential air quality impacts may be generated from the construction of the machinery shed/caretakers residence/ site office, intersection upgrade and haul route realignment. The construction works and all related activities are expected to be completed within a 1 – 2 month period. The intensity of the activities will be highly varied depending on the schedule of construction.

Air quality impacts from the proposed construction activities are likely to be low due to the short-term construction duration, the buffer distance to sensitive receptors and the dense vegetation surrounding the site.

8.4 Mitigation Measures

8.4.1 Construction Stage

Short term construction will be managed in accordance with *NSW OEH Air Quality Guidance Note for Construction Sites*.

Methods for managing the potential impacts will include:

- early and ongoing communication with potentially affected receivers to inform of the proposed works, duration and potential for dust;
- keeping truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices;
- placing as much distance possible between plant or equipment and other sensitive land uses; and

Where air quality complaints are received during the construction period, monitoring may be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.

8.4.2 Operational Stage

In addition to universal work practices to minimise the site generated dust, the following air quality control recommendation is provided to minimise emissions during the operational phase of the proposal:

- during sand extraction operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day.

9 ENVIRONMENTAL IMPACT ASSESSMENT: BIODIVERSITY

A Biodiversity Development Assessment Report (BDAR) has been prepared in accordance with the Biodiversity Assessment Methodology (BAM) (OEH 2017) by Wildthing Environmental Consultants.

A copy of the BDAR is located at **Appendix D**.

9.1 Overview

The objective of the BDAR is to address the requirements of the Secretary's Environmental Assessment Requirements (SEARs) listed below:

"The EIS must assess the potential impacts of the proposal at all stages of the development, including the establishment, operation and decommissioning of the development.

The EIS must address the following specific issues:

Biodiversity – including:

- *accurate predictions of any vegetation clearing on site;*
- *a detailed assessment of the potential biodiversity impacts of the development in accordance with the Biodiversity Assessment Method (BAM), paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems;*
- *a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant;*
- *an assessment of whether a Species Impact Statement is required; and*
- *consideration of weed management".*

No additional or specific threatened species, populations or communities were specified in the SEARs or by the then NSW Office of Environment and Heritage (OEH) for consideration.

In addition, the BDAR has

- identified how the proponent proposes to avoid and minimise impacts to biodiversity;
- identified any potential impact that could be characterised as serious and irreversible; and
- described the offset obligations required to compensate for any residual biodiversity impacts resulting from the proposed development in accordance with the Biodiversity Offsets Scheme (BOS)

All biodiversity assessments have been undertaken in accordance with the BAM.

9.2 Existing Biodiversity Environment

The site is situated on the southern side of Nelson Bay Road and is bounded by the Stockton sand dunes to the south and predominantly bushland to the east and west.

The site is currently vegetated except for that part of the site at the rear (south) which contains the electrical easement and the encroaching dune. There is also a cleared area of land just to the north of the easement, a cleared access track running north to south through the site and a cleared area of land containing a dwelling. The existing vegetation has been assessed by Wildthing Environmental Consultants as dry open sclerophyll forest dominated by the canopy species *Eucalyptus pilularis* (Blackbutt) and *Angophora costata* (Smooth-barked Apple). The majority of this community is in moderate condition; however, the northern portion of this community has been exposed to recent disturbance in the form of underscrubbing which has modified the midstorey and understorey layers and removed a number of less mature canopy trees. At the time of survey, a small area in the north west of the study area was composed of cleared grassland and a shed, a grassy electrical easement ran through the southern portion of the study area. Two access tracks also ran north-south through the study area

252 individuals of the Rough Doubletail Orchid were recorded within the site, 234 individuals were recorded within the transmission line easement (vegetation zone 1648_DNG) and 18 individuals were recorded within the coastal forest (vegetation zone 1648_Intact).



Plate 9-1: Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula (Intact) (PCT 1648)
(Source: Wildthing Environmental Consultants)



Plate 9-2: Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula (Modified) (PCT 1648)
(Source: Wildthing Environmental Consultants)



Plate 9-3: Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula (Ausgrid Electricity Easement) (PCT 1648)

(Source: Wildthing Environmental Consultants)



Plate 9-4: Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion (PCT 1204)

(Source: Wildthing Environmental Consultants)



Figure 9-1: Plant Community Type Map

(Source: Wildthing Environmental Consultants)



Plate 9-5: Rough Doubletail Orchid

(Source: Wildthing Environmental Consultants)



Figure 9-2: Species Polygon Map

(Source: Wildthing Environmental Consultants)

The following fauna were located on site by survey:

- *Limnodynastes tasmaniensis* (Spotted Marsh Frog)
- *Haliaeetus leucogaster* (White-Bellied Sea Eagle)
- *Soodon macrourus* (Northern Brown Bandicoot)
- *Antechinus stuartii* (Brown Antechinus)
- *Rattus rattus* (Black Rat)
- *Miniopterus australis* (Little Bentwing Bat)
- *Vespadelus* sp. which could only be identified to the genus level.

9.3 The Proposal

The proposal will only require minimal clearing for the site office/manager's residence and associated asset protection zone and the minor realignment of a pre-existing access track running north through the study area to allow for the movement of heavy vehicles.

The sand extraction will not remove live vegetation from the dune face. Proposed sand extraction in the area of the dune containing vegetation will only occur once the encroaching sands result in the death of this vegetation as has occurred already occurred in part of the site.

In all, it is expected that approximately 1 hectare of vegetation is to be removed.

9.4 Potential Biodiversity Impacts

The following sections provide assessment of the extent of the residual impacts unable to be feasibly avoided and an assessment of the likelihood of residual indirect impacts which may occur after considering the feasibility of avoidance and minimisation strategies proposed.

9.4.1 Direct Residual Impacts

The construction phases of the proposal have the potential to directly impact biodiversity values, largely due to the clearing of native vegetation for the site office/manager's residence and the associated asset protection zone as well as the minor realignment of the vehicular access track within the site.

The direct impacts arising from the project include:

- the removal of 0.22 ha of Vegetation Zone 1648_DNG
- the removal of 0.59 ha of Vegetation Zone 1648_Intact
- the removal of 0.11 ha of Vegetation Zone 1204_Sparse
- the potential removal of 2 hollow-bearing trees within Vegetation Zone 1648_Intact
- the removal of threatened species habitat, including the removal of 0.81 ha of suitable habitat for the species credit species Rough Doubletail

9.4.2 Indirect Residual Impacts

Indirect impacts occur when a proposal, or activities relating to the construction or operation of a proposal, affect native vegetation, threatened ecological communities and threatened species habitat beyond the study area. Impacts may also result from changes to land-use patterns.

Table 9-1 provides an assessment of the potential indirect residual impacts on the study area and adjacent vegetation in accordance with required BAM.

Table 9-1: Indirect Impact Assessment

Indirect Impact	Assessment/ Likelihood of Occurrence
Inadvertent impacts on adjacent habitat or vegetation	The proposed development has the potential to result in inadvertent impacts on adjacent retained habitat or vegetation. However, the mitigation measures described in sections below will minimise the likelihood of occurrence of this indirect impact during the construction phase of the project.
Reduced viability of adjacent habitat due to edge effects	The proposed development will not result in a significant increase in edge effects impacting upon the retained vegetation. The majority of the site has been historically disturbed and as such edge effects have been an ongoing impact to the retained vegetation within the study area. The proposed development will increase edge effects to a small portion of the vegetation present in the southern and eastern corners of the study area. This vegetation is currently disturbed and will remain connected to other areas of higher condition vegetation and as such any increased edge effects are expected only to result in negligible impacts.
Reduced viability of adjacent habitat due to noise, dust or light spill	The proposed development has the potential to result in impact to fauna habitat due to noise, dust and light spill. However, the mitigation measures described in the sections below will minimise the likelihood of occurrence of this indirect impact during the construction and operational phase of the project.

	An air quality impact assessment has been conducted for the sand extraction activity during the operations phase (Advitech 2018), from this it was determined that the extraction activities will be below the NSW EPA impact assessment criteria as a result of cumulative impacts.
Transport of weeds and pathogens from the site to adjacent vegetation	The proposed development has the potential to result in an increase of weed spread within the study area and adjacent vegetation. However, the mitigation measures described above will minimise the likelihood of occurrence of this indirect impact during the construction and operation phase of the project.
Increased risk of starvation, exposure and loss of shade or shelter.	This is unlikely to occur as the proposed development will not substantially modify vegetation within the study area or surrounding habitat such that a significant loss in foraging, hunting and shelter resources would occur.
Loss of breeding habitats	Two hollow-bearing trees were recorded within the development footprint and both could potentially require removal as a result of the proposed development. However, the mitigation measures described above will ensure that no net loss of hollows will result from the proposed development.
Trampling of threatened flora species	The proposed development has the potential to result in inadvertent impacts to a population of Rough Doubletail within the study area via inadvertent trampling. A method for ensuring the protection of this population i.e. appropriate signage and exclusion fencing, should be sought by the client in consultation with Ausgrid.
Inhibition of nitrogen fixation and increased soil salinity	The proposed development will not result in the removal of a substantial area of native vegetation, there is also large patches of vegetation, both within and adjacent to the study area, that will not be impacted. As such it is not considered likely that nitrogen fixation or soil salinity will be impacted.
Fertiliser drift.	No fertiliser is proposed to be used.
Rubbish dumping.	Mitigation measures and standard construction environmental controls will ensure potential impact from rubbish dumping is minimised.
Wood collection.	The proposed development is industrial in nature and it is considered unlikely those persons who will work at the site will collect wood from the retained vegetation.
Bush rock removal and disturbance.	The sandy soil present within the study area does not support bush rock.
Increase in predatory species populations.	There is no proposed change to land use that will likely lead to an increase in predatory species populations.
Increase in pest animal populations.	There is no proposed change to land use that will likely lead to an increase in pest animal populations.
Increased risk of fire.	There is no proposed change to land use that will likely lead to an increased risk of fire.
Disturbance to specialist breeding and foraging habitat, e.g. Beach nesting for shorebirds.	No specialist breeding habitat occurs within the study area. A number of shorebirds are likely to utilise Stockton Sand Dunes for both foraging and nesting; however, no shorebird species have

	been recorded within the sand dunes likely to be affected both directly and indirectly by the operational phase of the proposed development.
Fragmentation of movement corridors.	Vegetation to be removed within the study area comprises the eastern extent of a key green corridor and regionally significant habitat linkage, linking habitats surrounding the study area and across the greater landscape from the Watagan and Yengo National Parks to the coastal plains of the Tomago Sand beds, Stockton Bight and Port Stephens. As a worst-case scenario, within the study area, the width of the vegetated corridor will be reduced, as a result of the proposed development, from approximately 550m to 450m wide. This is not considered likely to result in substantial or significant adverse impedance to mobile fauna species and some flora species that may use the vegetation within the study area corridor for dispersal. Large areas of vegetation, present in similar ecological condition, will be retained maintaining the corridor at, or just below, its current functionality. Direct impacts to this movement corridor (removal of 0.81 hectares of vegetation at the southern boundary of the corridor) are considered incremental and minor when being considered at the landscape scale. Indirect impact to this corridor from the proposed development would be primarily restricted to a potential increase in vehicle strikes of fauna arising from increased vehicle movement within the study area. However, the mitigation measures described will minimise the likelihood of occurrence of this indirect impact during the construction phase of the project

(Source: Wildthing Environmental Consultants)

9.4.3 Prescribed Impacts

Prescribed impacts are the impacts on biodiversity values which are not related to, or are in addition to, native vegetation clearing and habitat loss (Section 6.7 of the BAM). In general, these types of impacts identify habitat or features of the environment that are irreplaceable. Assessment of prescribed biodiversity impacts are outlined and addressed in **Table 9-2** below.

Table 9-2: Prescribed Impacts Assessment

Prescribed impact	Assessment / likelihood of occurrence
Impacts of development on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance.	No karst, caves, crevices, cliffs and other features of geological significance will be impacted by the proposed works.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks.	No significant clusters of rocks were present within the study area.
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	No human made structures will be impacted by the proposed works.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	An area of non-native vegetation was recorded within the north of study area in the form of maintained introduced grass and a small amount of exotic trees and shrubs. No threatened species that rely on this non-native vegetation as a habitat resources were recorded or predicted to occur within the study area during the assessment.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	Vegetation to be removed within the study area comprises the eastern extent of a key green corridor and regionally significant habitat linkage, linking habitats surrounding the study. The small amount of vegetation removal proposed is not considered likely to result in substantial or significant adverse impedance to mobile fauna species and some flora species that may use the vegetation within the study area corridor for dispersal.
Impacts of the development on movement of threatened species that maintains their life cycle	A number of threatened species are likely to utilise the vegetation within the study area however the movement of threatened species throughout the study area is not expected to be adversely affected given the recommendations of avoidance and minimisation of impacts proposed.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)	No waterbodies or waterways were present within the study area. In addition, no aquifers or ground water dependant ecosystems were mapped within the study area (BoM 2018) nor would the operational effects of the proposed development require penetration of an aquifer.
Impacts of wind turbine strikes on protected animals	N/a
Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	Vehicle strikes on threatened species have the potential to occur within the construction and operational phase of the development. Methods to avoid potential occurrences of vehicle strike on threatened species have been detailed.

(Source: Wildthing Environmental Consultants)

9.4.4 Impacts to Groundwater Dependent Ecosystems

The study area is not mapped as being a ground water dependent ecosystem (BoM 2018) or associated with a known aquifer.

The NSW DPI step by step guide for assessing a proposal against the NSW Aquifer Interference Policy states: *If an activity is not defined as an aquifer interference activity, then assessment is not required under the Aquifer Interference Policy.*

The Water Management Act defines an aquifer interference activity as an activity involving any of the following:

- The penetration of an aquifer.
- The interference with water in an aquifer.
- The obstruction of the flow of water in an aquifer.
- The taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations., and/or the disposal of that water.

The proposed development is not associated with any mapped GDEs nor will it require subsurface penetration or aquifer interference activity and as such, will not impact upon GDEs.

9.4.5 Serious and Irreversible Impacts (SII)

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline, or
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size, or
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

No threatened matter consistent with a SAI candidate species identified as likely to occur or to contain significant habitat within the study area is likely to be impacted by the proposed development.

9.5 Mitigation Measures

The BDAR proposes the following mitigation measures.

9.5.1 Actions to Avoid/Minimise Project Impacts

The principal means to reduce impacts on biodiversity within the study area has been to avoid and minimise removal of native vegetation and fauna habitat and to avoid the direct loss of significant biodiversity values and threatened matters. The potential impacts resulting from the proposed development have been broken down into three phases of activity: planning and detailed design, construction and operation. Mitigations measures are included for each component of the proposed development.

9.5.2 Planning and Detailed Design

The proponent considered biodiversity values present within the study area and sought advice from Wildthing Environmental Consultants in the planning and detailed design stages of the development layout to avoid, where possible, direct impacts to identified biodiversity values. The current development layout has been selected, in part, to minimise impacts to significant biodiversity values, threatened matters and flora and fauna habitats present within the broader study area.

The presence of the threatened flora species Rough Doubletail within the study area has affected the final detailed design of the ancillary facilities within the study area (site office/manager's residence and associated APZ). During the conceptual design phase for the proposed development the ancillary facilities were planned to be located closer to the sand extraction operations area directly adjacent to the north of the Ausgrid easement. A preliminary ecological constraints analysis was conducted by Wildthing during initial scoping of fieldwork, it was determined that a large population of Rough Doubletail were present within the easement. Accordingly, the final development layout was revised and the site office/ manager' residence and associated APZ is now proposed for location within the east of the study area. Its revised location contains fewer actual and potential biodiversity values.

All direct impacts to the area containing the Rough Doubletail has been avoided as has the loss of a significant concentration of hollow-bearing trees present within the southern section of the study area.

Access to the sand dunes within the south of the study area will be required for heavy reticulated vehicles and plant machinery to export sand from the study area. Minimisation of the clearance of native vegetation required for vehicle access was

considered during the detailed design phase of the development and use of the pre-existing access track running north-south through the site is proposed to facilitate vehicle movement.

The sand material to be mined is transgressive by nature and its extent is constantly changing according to prevailing winds buffeting the study area from the south. It is expected, based upon previous observations made by the proponent that the dunes to the east and west of the current sand incursion area will advance over time, eventually encompassing the native vegetation present to the south of the Ausgrid easement and causing vegetation to die, as has been the case previously. Only when this occurs, the proponent would extend sand extraction operations to include this area to the extent illustrated in plans and the subject of any development consent.

9.5.3 Construction

Construction of the proposed development will require removal of native vegetation within the east of the study area. Construction of the site office/manager's residence will also require the establishment of an associated asset protection zone with a radius of approximately 35m from the edge of the building footprint.

Although it is likely that a significant amount of the canopy within this area will be retained, a conservative approach has been adopted and all trees within the APZ have been considered likely to be removed and have been included within the residual impact assessment.

Recommendations for further avoidance and minimisation strategies during the construction phase are detailed in **Table 9-3**.

Table 9-3: Further avoidance and minimisation strategies for the construction phase

Nature of Potential Impact	Avoidance/minimisation Strategy Proposed	Timing	Responsibility
Clearing of native vegetation	Where possible, construction works should avoid any impact to mature trees. Where unavoidable, works should minimise impacts to mature trees as follows: - clearing limits will be clearly marked to prevent unnecessary clearing beyond the extent of the development footprint. Tree clearing and disturbance will be limited to the development site, - where a tree must be disturbed the priority should be given to pruning rather than clearing; and - the clearing of any trees should be undertaken in a manner that avoids damaging adjacent vegetation i.e. all trees should be felled into disturbed areas when feasible.	Prior to and during vegetation clearing	Construction site manager
Inadvertent impact to biodiversity values	Priority will be given during construction to avoid any inadvertent impact to significant biodiversity values within the study area. Avoidance measure should include the following: - appropriate signage, such as 'No Go Zone' or 'Environmental Protection Area', and exclusion fencing where relevant, should be installed where construction and operation is near significant biodiversity values i.e. location of Rough Doubletail population, - the location and significance of all ecological constraints within the study area should be made known to all contractors and staff. Annotated site plans would be displayed in lunch room / site offices. Specific management measures required near constraints areas should be discussed in tool box talks and as part of all inductions, - all material stockpiles, vehicle parking and machinery storage will be located within cleared areas proposed for clearing, and not in areas of native vegetation that are to be retained, - establishment of wet down areas to reduce dust generation during construction, - implementation of temporary stormwater controls during construction and to ensure that discharges to the drainage channels are consistent with existing conditions; and - temporary erosion and sediment controls (e.g. silt fences, sediment traps) should be installed prior to construction to avoid disturbance and degradation of soils and	Prior to and during vegetation clearing	Construction site manager

	nearby features (e.g. water ways, adjacent habitat and vegetation). These should conform to the specifications in Soils and Construction 'Blue Book' (Landcom, 2004) and should be maintained throughout the construction process until soil is successfully stabilised.		
Clearing of fauna habitat, resulting in fauna injury and mortality	A suitably qualified and experienced ecologist should be engaged to supervise removal of all significant habitat features as displayed in the BDAR and maintain a vegetation clearance register which should include the location, type, size of felled habitat trees and any contact with resident fauna. The supervising ecologist would work co-operatively with the plant operator to develop an adaptive clearance methodology that should minimise impacts to potential resident fauna whilst being conducted according to safe work methods. The adaptive clearance methodology should include the following key aspects: • seeking consultation with a suitably qualified ecologist to determine the best time to schedule clearance works to avoid nesting and breeding times for resident fauna • preclearance surveys completed on the morning of any clearance works to determine if any nesting birds or canopy dwelling mammals are within the clearance footprint, • clearing utilising a 'soft felling' technique in which trees are 'nudged' by machinery and fauna given time to leave (overnight), before slowly felling the tree the following day, • if fauna is identified within the proposed clearing area prior to clearing, or after 'nudging' the tree, operations will cease until the fauna has moved to a safe location or has been relocated. If fauna flee into a habitat tree demarcated for removal this tree should also be nudged and left to fell until the following day, • any captured displaced fauna relocated to the nearest area of appropriate habitat. If arboreal, the fauna to be placed inside an artificial nest box and relocated. If the displaced fauna is nocturnal relocation to occur during dusk; and • all hollow logs and felled trees would be inspected by the ecologist before relocation into areas of similar adjacent habitat, All habitat tree felling activities and results to be summarised in a tree clearance report by the	Prior to and during vegetation clearing	Construction site manager and suitably trained fauna handler

	supervising ecologist, including fauna injuries. All fauna sightings/captures would be recorded and uploaded to the NSW Wildlife Atlas.		
Salvage of significant habitat features	Habitat salvage within the development footprint should be undertaken prior to and during clearance activities, with the salvage methodology including the following key aspect: - Tree limbs containing natural hollows should be relocated and restored for use by fauna in the nearest adjacent area of similar habitat by a suitably qualified ecologist. Where natural hollows cannot be relocated an artificial nest box should be installed onto a tree in the nearest adjacent area of similar habitat by a suitably qualified ecologist, - the nest boxes selected would be of a similar size and dimension to the hollow removed; and - nest boxes would be installed at a ratio of 1 nest box per hollow to be removed. Where removal of woody debris is required: - dead trees and woody debris that are removed (diameter >10 cm) to be placed in the nearest adjacent area of similar habitat by a suitably qualified ecologist.	Prior to and during vegetation clearing	Construction site manager and suitably trained fauna handler

9.5.4 Operation

The operational effects of the proposed development will primarily be restricted to the sand extraction process within the south of the site and the entry/egress of reticulated vehicles and plant machinery via Nelson Bay Road. To minimise the removal of vegetation within the south of the study area, the extraction of sand will be restricted to the area of Stockton Sand Dunes that has encroached into the site burying vegetation in its path. This area is primarily composed of bare Aeolian sand with a small amount of native vegetation which has a low structure, function and composition score.

Recommendations for further avoidance and minimisation strategies during the operational phase of the proposed development are illustrated in **Table 9-4**.

Table 9-4: Further avoidance and minimisation strategies for the operational phase

Nature of Potential Impact	Avoidance/minimisation Strategy Proposed	Timing	Responsibility
Avoiding operational impacts on flora and fauna	Measures to reduce impact to resident fauna and flora within the study area during the operations phase should be implemented including: - vehicle movement within the study area to be restricted to operational hours Monday-Friday, - vehicle speed within the study area to be limited according to adjacent habitat value and road condition (e.g. 10km/hr), - no workers to be permitted to bring dogs onto the site, - all food waste to be disposed of in covered waste bins; and - a register of all disturbances to fauna caused during site operations to be kept and updated by the site manager, In addition, measures to supply further protection from operation impacts to the Rough Doubletail population within the Ausgrid easement should be considered, this could be inclusive of permanent exclusion fencing, sedimentation barriers and spill management controls. All measures to further protect this population would be sought in consultation with Ausgrid who maintain ownership and responsibility for the easement and require periodic access for maintenance works.	For life of operational phase	Site manager
Assisting injured fauna	Any animals injured during operations should be taken immediately to the Salamander Bay Veterinary Clinic (Open 9am-6pm weekdays) or equivalent for treatment. Any animals suspected to require rehabilitation would be delivered to an appropriate animal rehabilitator	For life of operational phase	Site manager

	associated Hunter Wildlife Rescue (Telephone No. 0418 628 483).		
Minimise weed infestations	The following measures should be implemented to prevent exotic plant material from entering/exiting the study area: • no imported/exported material to be permitted unless it has been inspected and confirmed to be free of dirt and mud which may contain weed seeds and vegetative material such as bulbs, root fragment, tubers or rhizomes; and • vehicles and machinery to be clean of soils, vegetation and seeds that have been brushed off or washed down prior to entering the study area • A clean down register to be maintained at the entry of the study area	For life of operational phase	Site manager
Treat existing weed infestations	All employees and sub-contractors working within the study area should be educated on the identification of noxious weed species known to occur or with potential to occur during site specific induction. A protocol of reporting and mapping any sightings of these species would be developed by the site manager. As a part of maintenance within the study area any high threat weeds known to occur will be controlled in accordance with appropriate DPI guidelines. Guidelines for the treatment of high threat weeds can be sourced within the DPI website (DPI 2018).	For life of operational phase	Site manager
Prevention of excessive dust	Unsealed access roads and operational areas should be regularly watered to limit dust generation, particularly in windy conditions.	For life of operational phase	Site manager
Reduce impacts of artificial lighting	Any artificial lighting used for security at night should be angled/directed downwards to avoid excessive light pollution affecting adjacent habitat.	For life of operational phase	Site manager

10 ENVIRONMENTAL IMPACT ASSESSMENT: ABORIGINAL CUTURAL HERITAGE

An Aboriginal Cultural Heritage Assessment (ACHA) has been prepared (Niche Environment & Heritage) to establish the Aboriginal cultural heritage impacts associated with the proposed development.

A copy of the ACHA assessment is located at **Appendix E**.

10.1 Existing Aboriginal Cultural Heritage Environment

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas. The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The land and waters have been used for thousands of years for hunting and gathering foods, fishing and the continuation of cultural, spiritual and sacred activities. Aboriginal cultural connections have always been strong in this area and continue today, as it is still a well utilised fishing and recreational area used by Worimi people.

According to the Australian Bureau of Statistics, approximately 4.8% (3,325 people) of the population within the Port Stephens LGA currently identify as Aboriginal and/or Torres Strait Islander.

Activities that are likely to have occurred within the site and its general locality include:

- Hunting and gathering of foods (shellfish and other marine resources).
- Intermittent camping and occupation.

10.2 Potential Aboriginal Cultural Heritage Impacts

The ACHA included background archaeological and historical investigation, ongoing consultation with Registered Aboriginal Parties (RAPs) and an archaeological survey that included representatives from Mur-rooma Incorporated, Worimi Traditional Owners Indigenous Corporation, Karuah Indigenous Corporation, Worimi Local Aboriginal Land Council, and Nur-Run-Gee Pty Ltd.

During the survey, it was determined that the southern section of the land contained an area of high sensitivity within a sand dune system, which may be a continuation of a previously recorded Aboriginal cultural heritage site, AHIMS ID#38-5-032. The area of sensitivity was named Anna Bay PAD-1 (AHIMS ID#38-5-0347) and would be impacted by the proposed activity.

Subsequently, an Aboriginal Heritage Impact Permit (AHIP) was applied for under s.90 of the *National Parks and Wildlife Act 1974* to allow harm to Aboriginal objects by test excavation at the Anna Bay PAD-1 (AHIMS ID#38-5-0347) Aboriginal cultural heritage site. The AHIP (C0004974) was issued on 8 July 2019.

The test excavation was carried out over three days from 23 to 25 July 2019. Sixteen test pits, measuring 50 cm x 50 cm, were excavated. No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 was not an Aboriginal cultural heritage site. An Aboriginal Site Impact Recording Form (ASIRF) was submitted to the Biodiversity and Conservation Division (BCD), Department of Planning, Industry and Environment, advising of the updated status "Not a Site".

No further investigation or impact assessment is required. Works may proceed with caution without a further Aboriginal Heritage Impact Permit.

Impacts of the proposed development on matters of Aboriginal cultural heritage area unlikely.

10.3 Mitigation Measures

The ACHA provided the following mitigation recommendations.

Recommendation 1:

- All workers are to be inducted into the site so that they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future consent with respect to Aboriginal heritage prior to and during and after construction activities.

Recommendation 2:

- In the unlikely event of the identification of artefacts within the site, work in the surrounding area is to stop immediately. A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site. In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material. If the material is an Aboriginal object, the proponent will:

- Notify the BCD's Enviroline and representatives of the RAPs;
- Facilitate, in co-operation with the appropriate authorities and the RAPs, the recording and assessment of the finds;
- Comply with any legal requirements and BCD directions; and
- Develop and implement appropriate management strategies based on an assessment of significance of the finds.

Recommencement of ground disturbance works may only resume once legal requirements are fulfilled.

Recommendation 3:

- All workers are to be inducted into the site so that they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of consent prior to and during and after construction activities.
- In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact must cease immediately. The location, including a 20 m curtilage, must be secured using barrier fencing to avoid further harm. The NSW Police must be contacted immediately. No further work is to be undertaken until the NSW Police provide written notification to proceed. If the skeletal remains are identified as Aboriginal, the proponent or their agent must notify the BCD's Enviroline and representatives of the RAPs. No works are to continue until the BCD provides written notification to the proponent or their agent. An Aboriginal Heritage Impact Permit may be required to manage human remains.

11 ENVIRONMENTAL IMPACT ASSESSMENT: HISTORIC HERITAGE

A Historic Heritage Assessment (HHA) has been prepared (Niche Environment & Heritage) to establish the historic heritage impacts associated with the proposed development.

A copy of the HHA assessment is located at **Appendix F**.

11.1 Existing European Heritage Environment

11.1.1 Early European Settlement

The following subsections present a brief summary of historical development of the subject site and Anna Bay more broadly (summary extracted from Niche Environment & Heritage, 2018).

The Stockton Bight was first noted by Captain James Cook in 1770 and later mapped by Lieutenant John Shortland in 1797. Settlement Anna Bay is located at the north-eastern end of Stockton Beach in the Hunter Region of New South Wales. It is located on the southern side of Port Stephens which is located to the south of the one million acre land grant to the Australian Agricultural Company (AA Co.) William Cromarty, who was involved with the AA Co. settled outside of the Company's holding at Soldier's Point which is north of Anna Bay (Refer to **Figure 11-1**).

The first European settlement in the area involved the establishment of dairy farms, which were constrained to the low-lying areas of Anna Bay in the 1830s. An unsealed government road, which became the current Nelson Bay Road was established that linked Stockton with Nelson's Bay in the mid nineteenth century, but regular use of the road by cars did not occur until the 1920s.

During World War II, the road between Stockton and Anna Bay was improved and greater access encouraged more activity to occur in the area, such as holiday accommodation and residential and tourism development. Sand mining for heavy minerals commenced in 1968 at Anna Bay (located to the east of the subject site), with other mines opening in Salamander, Bobs Farm, Tanilba, Oyster Cove, Williamtown and Medowie from the 1950s onwards.

The subject site is located within a land grant belonging to a W. T. Blanch, who is likely John and Lucy Blanch's son William, born in 1863. The Blanch family owned much of the land within the Anna Bay area in the earliest days of European settlement, from at least the 1850s. It is unknown, from documentary evidence what activities took

place within the subject site, but it has remained predominately uncleared of native vegetation until the present day.

The subject site is also located adjacent to the second (and third) Anna Bay Public School buildings (known until 1896 as Hannah Bay Public School). The first school was gazetted in September 1879 and the proposed structure was a slab and bark hut capable of holding twenty pupils. The school was located within William Blanch's land fronting the government road on the northern side of the current Nelson Bay Road. Construction of the first school was completed in November 1879. When this primitive structure was outgrown, a new plot of land was purchased south of the government road a new school was constructed in 1884. The school was a rounded roof structure made of corrugated iron. It had a verandah and an internal stepped floor with long bench desks which allowed the pupils and teachers to see each other more clearly. This school was demolished and replaced by a new structure in 1910 within the same plot. The newer building consisted of a 21 feet squared hipped roof building with a verandah and a flat floor. The remains of the second school were used to construct a lean-to within the school grounds. The school building is visually separated from the subject site by a later subdivision.



Figure 11-1: Plan of the Australian Agricultural Company's grant at Port Stephens 1828

[cartographic material] / engraved by J. Cross 18 Holborn London Online images available via the State Library of NSW at: <http://acms.sl.nsw.gov.au/album/albumView.aspx?itemID=9>

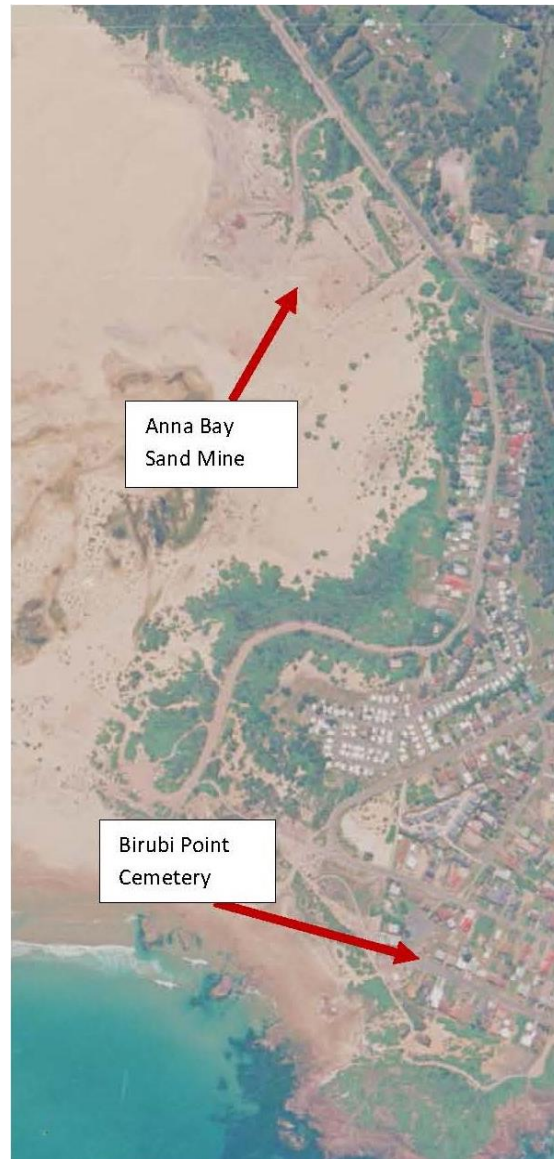


Figure 11-2: 1985 aerial photo showing the existing sand mine and Birubi Point Cemetery
(Source: Niche Environment & Heritage)

11.1.2 Birubi Point Cemetery

Birubi Point is located approximately 2.3 km from the subject site. Birubi Point Cemetery was in use between 1876 and 1996 and contains the graves of early settlers to the area as well as shipwrecked persons, some of who were unidentified. The cemetery is located adjacent to the original lot of land settled by the Blanch family in the 1950s. The point on which the cemetery is located was known as Cemetery Point, until the name was officially changed in 1976 and it is now located within the lands of the Birubi Point Aboriginal Place. The first interment in 1876 was that of Lucy Blanch who was an Anna Bay pioneer. The cemetery contains a layout plan on a plaque and includes a list of all the known burials within the cemetery, numbering 88 internments.

11.1.3 Stockton Beach Dune System

Stockton Beach dune system is the largest moving coastal land mass in the southern hemisphere, located between Stockton and Anna Bay and covering a distance of approximately 25 kilometres in length. The dunes are moving inland at a rate of about one metre per year, following their destabilisation in the nineteenth century by severe storms and cattle grazing. According to the Register of the National Estate, the entire bight (stretching from the Hunter River Estuary to Birubi Point in the north) is of significance for its unique natural ecosystem.

As a result of the shifting sand sheet, Aboriginal midden sites, burials and education sites important to the Worimi peoples, as well as World War II fortifications, are periodically covered and revealed by the moving sands. The defence lines that were constructed on Stockton Beach during World War II were part of the Northern Defence Line, which was a part of the nationwide response to the Japanese attacks on Darwin and submarines entering Sydney and Newcastle harbours. The defensive tank traps were set up along the entire line of the beach, and infantry-manned heavy and light artillery stations were established at the southern end of the beach at Fern Bay. Tank traps which were removed from their emplacements now form the boundaries of an

overflow carpark just below Birubi Point at the northern end of the beach. The northern end of the beach, located south of Birubi Point was used as a bombing and military training location during World War II. The weapons range, which was established during the war with an area approximately totalling 400 hectares, including an area directly to the south of the subject site. The area continued to be used as a RAAF weapons range until at about 1965 (see **Figure 11-4**). Unexploded ordinance is still recovered from the sand dunes and are subject to protocols from the NSW Police and Department of Defence.

Located within the central section of the beach, behind the foredune, are a group of eleven corrugated iron structures with gable or skillion roofs. They have been named "Tin City" by the local population. The original huts date to the 1940s and 50s and were constructed for use by recreational fishermen in the area. The majority of the huts that are currently standing were constructed in the 1970s and 1980s, with the most recent hut constructed in 1992. None of the original huts from the 1940s and 1950s are still standing, but those that remain continue to be used by fishermen. The remains of destroyed huts on the southern and central areas of the beach remain under the shifting sand dune, subject to exposure by local sand drift.

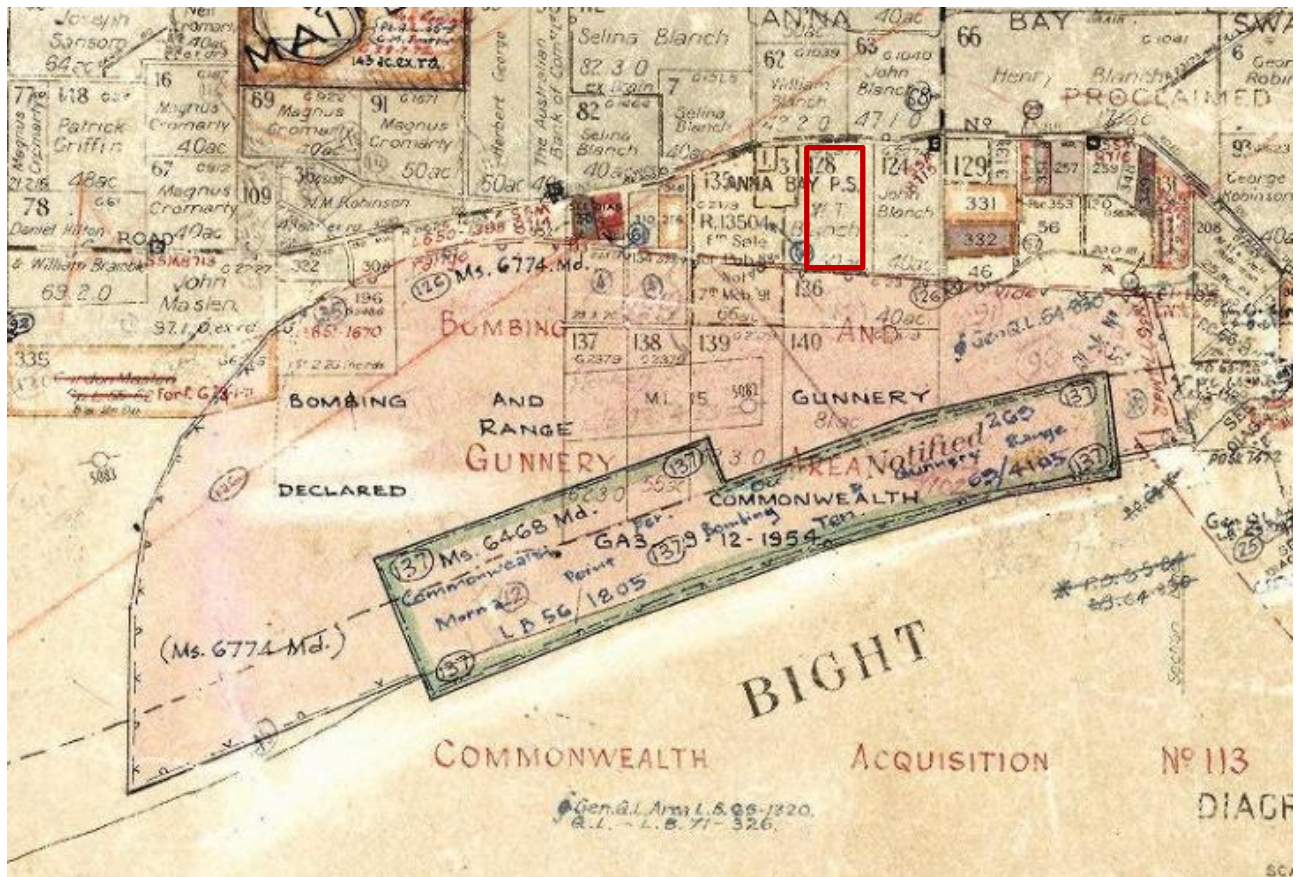


Figure 11-4: 1967 Tomaree parish map outlining "bombing and gunnery range" abutting onto the subject site (indicative location shown in red). (Source: Niche Environment & Heritage, 2018)

11.1.4 Modern Development

There are two garage buildings and a gabled roof building present fronting the road on 4226 Nelson Bay Road, in the earliest 1963 aerial available (see **Figure 11-4**). Directly to the west of the building group, within the subject site is a cleared and cultivated field. There are long, probably farm related structures running east-west across the property, approximately to the house and barns fronting the road. To the west, outside of the subject site, are a series of residential buildings (4206-4210 Nelson Bay Road) constructed between the subject site and the potential school building identified in on 4202 Nelson Bay Road. To the east of the subject site is a carpark, market building and the 'Baylife Church'. An unformed, cleared track through the native vegetation, most likely relating to the transmission line runs near the southern boundary of the subject site. It was most likely developed following the cessation of the RAAF activities to the south of the subject site.

In 1985, the east-west farm building located to the south of the main domestic building within the subject site has been demolished and the majority of the cleared farm paddock to the west of the domestic building has regrown vegetation. It should also be noted that the sand has encroached towards the transmission line from the south,

where it was not visible before. The transmission line has also been cleared and a gravel road surface added.

In 2015 Nelson Bay Road was widened and straightened, which meant that the residential dwelling present in the 1963 aerial was demolished. The remaining three garage buildings are located fronting the road now. The access track, which is proposed to be widened prior to mining commencing starting from between the garage buildings.

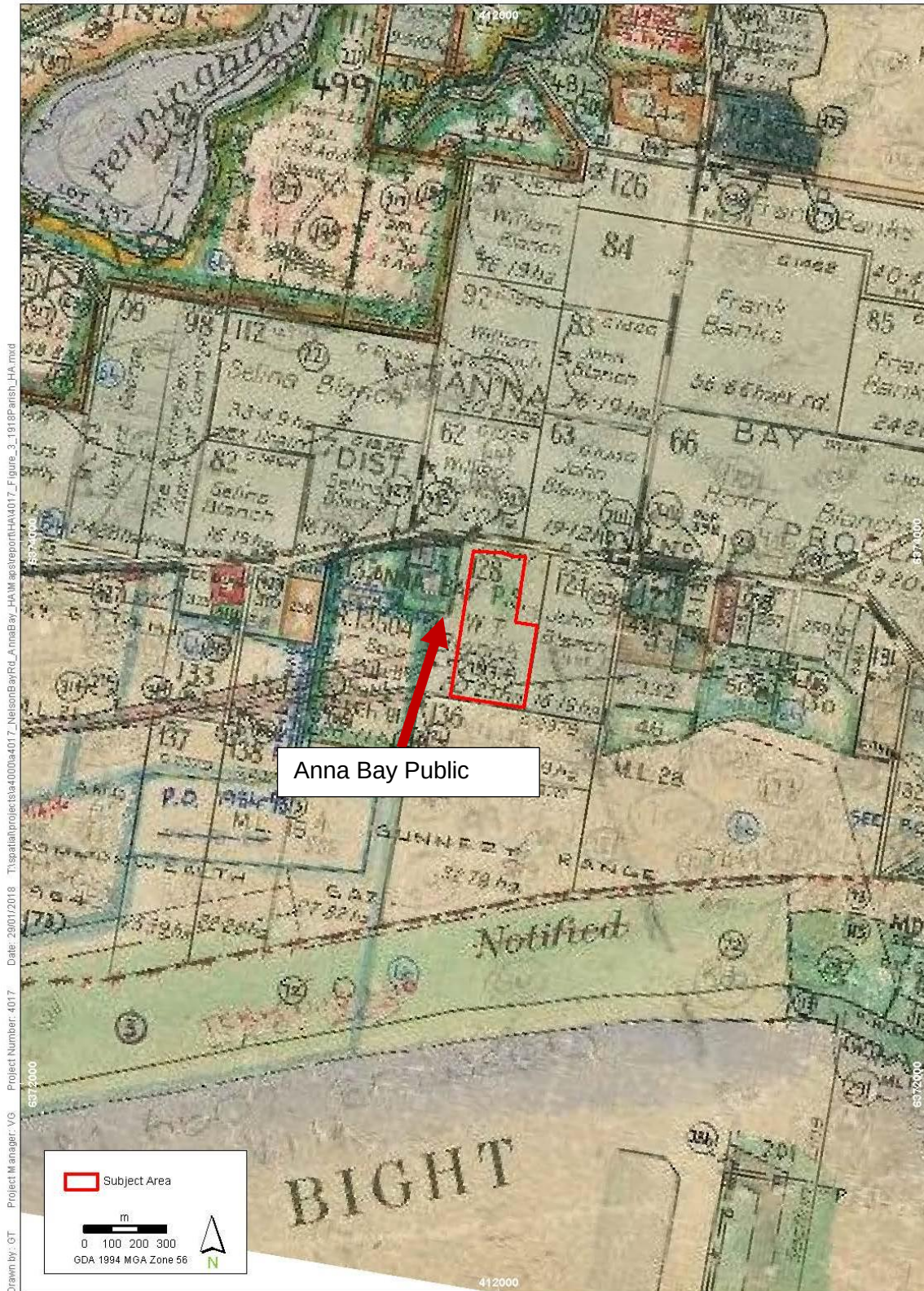


Figure 11-5: 1918 Tomaree Parish Map with the subject site outlined in red (Source LPI and Niche)



Figure 11-6: Aerial photo from 1963 showing the possible location of the second school building, and the cluster of structures within the subject site (approximately outlined in blue)



Figure 11-7: 1985 aerial with the approximate subject site outlined in blue

11.2 Potential Historic Heritage Impacts

The following subsections assess potential impacts of the proposed works on the heritage significance of Stockton Beach Dune System heritage item (SHI #2280081; LEP listing I34).

The *Statements of Heritage Impact* guidelines (NSW Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002) pose a range of questions for consideration when assessing heritage impacts. Of relevance to this assessment are questions concerning new landscape works and features, which are addressed below.

11.2.1 Direct (Physical) Heritage Impacts

The proposed activity will involve the extraction of sand up until the southern property boundary, this will cut into the existing sand dune profile, but it will not cut into the heritage listed portion of Stockton Beach Dune System. The mine will remove sand, as it moves from the beach into the electricity easement. Rehabilitation procedures, including revegetation will be undertaken in the quarry area to stabilise the sand. The sand extracted by the mine could have originally come from the listed portion of the dune system, but as it has moved from outside the curtilage and the sand will be cleared from the existing transmission line easement.

The activity will not cause any impact upon the Stockton Beach Dune System, as the subject site is located outside of the heritage curtilage of the item.

The original Anna Bay School building is located to the west outside the boundary of the subject site. The school site is not listed on any heritage register and it is unlikely that any buildings associated with it are located within the subject site. No other heritage items are located within distance where they would be physically impacted, including the Birubi Point Cemetery (LEP item I2), or the Stockton Beach Dune System (LEP item I34). The proposed sand mine is also located outside of the curtilage of the Birubi Point Aboriginal Place.

11.2.2 Indirect (Visual) Heritage Impact

There will be no visual impact from the proposed activity onto Stockton Beach Dune System, as the sand is being removed from the back of the current barrier dune with battering to be constructed in accordance with the geotechnical assessment. The site office and manager's residence will be sheltered from view from the beach by the remainder of the sand dune that will not be extracted.

Due to the distances of the proposed activity from the other heritage items in the area (including Birubi Point Cemetery, and Birubi Point Aboriginal Place) there are no anticipated heritage impacts to these items. Birubi Point Aboriginal Place and Birubi Point Cemetery are located 3 km away from the subject site.

Following the completion of quarry activities, the back slope of the sand dune will be re-vegetated with local vegetation to stabilise further erosion and dune movement. This will not be visible from the curtilage of the Stockton Dune System, Birubi Point Aboriginal Place, or Birubi Point Cemetery as it will be at the back of the dune.

As the proposed works would not introduce any new visual elements into the landscape, the visual heritage values of nearby heritage items would not be impacted. The proposed works would therefore result in negligible impacts to these heritage items.

11.3 Potential Archaeological Impacts

There has been minimal development within the subject site and the property has been used primarily for small semi-rural farming. The original residential dwelling has been demolished and the associated garage and outbuildings remain facing Nelson Bay Road. The former Anna Bay Public School is located on a separate lot to the east of the subject site.

There are no identified areas of heritage significant archaeological potential at the subject site, and therefore ground disturbance in this area would not result in any impacts to archaeological relics.

Table 11-1: Summary of potential impacts to the heritage items from proposed sand quarry works

Item	Direct	Indirect	Archaeological
Extraction of sand to ground level	Neutral	Negligible	Neutral
Vegetation removal	Neutral	Negligible	Neutral
Construction of caretaker's cottage/site office and machinery shed	Neutral	Negligible	Neutral
Widening of existing access track	Neutral	Negligible	Neutral

11.4 Statement of Heritage Impact

A summary Statement of Heritage Impact is provided in **Table 11-2** below, as per the 'Statements of Heritage Impact' guidelines (NSW Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002)

Table 11-2: Statement of Heritage Impact

Aspects of the proposal that respect or enhance the heritage significance of the heritage conservation area	The proposed activity would not result in any direct impacts to the heritage significance of Stockton Beach Dune System nor impact any likely historical archaeological resources.
Aspects of the proposal that could detrimentally impact on heritage significance	The subject site is located s outside the gazetted curtilage for Stockton Beach Dune System. The sand will be extracted from the moving transgressive sand sheet, and not extracted from the body of the sand dune. These works would not be noticeably prominent in the landscape, and would not introduce significant intrusive fabric or overshadow any nearby heritage items. As such there will be no detrimental direct or indirect impacts from the proposed activity because it is outside the curtilage for the dune system.
Have sympathetic solutions been considered and discounted?	As no adverse heritage impacts have been identified, no other sympathetic solutions have been considered necessary.

There are no listed heritage items within, or directly adjacent to, the subject site. The subject site has been employed as a small farm-holding since the mid nineteenth century, although no heritage significant built fabric has been identified at the site.

No areas of archaeological potential for the recovery of heritage significant relics have been identified at the subject site.

The proposed works would therefore not impact on any heritage significant items or archaeological relics. There are no further non-Aboriginal (historic) heritage constraints relevant to the proposed development.

11.5 Mitigation Measures

Due to the fact that the proposal will have no impact upon heritage items, no immediate mitigation measures. However, as a precautionary consideration, the following recommendation is made.

In the event that historical archaeological relics are unexpectedly exposed during excavation, ground disturbance works should stop in the affected area and a suitably qualified historical archaeologist be engaged to assess the extent, condition and likely significance of the remains. Depending on the significance of the relics, notification of the discovery may be required in accordance with S.146 of the *Heritage Act 1977* and further approval may be required if impacts are proposed.

12 ENVIRONMENTAL IMPACT ASSESSMENT: TRAFFIC AND TRANSPORT

A Traffic and Transport Assessment has been prepared (Better Transport Futures) to establish the vehicular traffic impacts associated with the proposed development.

A copy of the Traffic Assessment is located at **Appendix G**.

12.1 Existing Traffic and Transport Environment

The most significant road in the network that serves the subject site is Nelson Bay Road. It is a classified main road, designated as the B63 route in the NSW main road network. It is an arterial road with the section in the immediate vicinity of the subject site upgraded to four lane dual carriageway standard in May 2015, applying a rural design standard. 100% of traffic that will access the site will use Nelson Bay Road.



Figure 12-1: Local Road Network

Source: UBD Australian City Streets Version 5.0



Plate 12-1: Nelson Bay Road looking east in the vicinity of the subject site.



Plate 12-2: Nelson Bay Road looking east from Nelson Bay Road / Port Stephens Drive Roundabout



Plate 12-3: Nelson Bay Road looking west from Nelson Bay Road / Port Stephens Drive Roundabout.

There is a central median in place preventing right turns along the section of the road from Bobs Farm to Anna Bay, except where specific turn facilities are provided. There are a number of right turn and U-turn bays for example at Trotter Road and Cromarty Lane, with every second bay suitable for large vehicles.



Plate 12-4: Trotter Road Seagull intersection and U-turn facility on Nelson Bay Road (looking East)



Plate 12-5: Seagull intersection allowing right turn movements at Nelson Bay Road / Trotter Road (looking east)



Plate 12-6: U-Turn Bay at Nelson Bay Road / Trotter Road

12.1.1 Port Stephens Road / Nelson Bay Road Roundabout

With right runs prohibited by a central median, traffic approaching the subject site from the west has to perform a U-turn at the roundabout controlled intersection of Nelson Bay Road with Port Stephens Drive. This is a four-leg intersection with the southern leg being Jessie Road.



Plate 12-7: Western approach to Nelson Bay Road / Port Stephens Drive Roundabout, looking east



Plate 12-8: Eastbound circulating lane through Nelson Bay Road / Port Stephens Drive Roundabout



Plate 12-9: Port Stephens Drive looking north from Nelson Bay Road Roundabout

12.1.2 Jessie Road

Jessie Road is a local road connecting to the Nelson Bay Road / Port Stephens Drive roundabout as the southern of four legs. It is an unsealed road providing access to a number of properties, including the Nelson Bay Pony Club, a carpark on the south eastern corner of the roundabout and an earthmoving business. It also provides access to the easement which carries electricity lines across the subject site. It has unofficial signposts noting the road as a 'No Through Road', with no access to the beach or sand dunes.



Plate 12-10: Jessie Road looking north toward the Nelson Bay Road / Port Stephens Drive Roundabout

The most significant observations from a traffic movement, efficiency and road safety perspective that were observed from the data monitoring and subsequent site observations were:

1. Road network traffic flows appear to be well within technical capacity limits of the road system;
2. Heavy vehicles were a small percentage within the traffic stream on Nelson Bay Road through Anna Bay; flows were around 6.5 to 7% of recorded total flows.
3. Bus movements were observed along Nelson Bay Road
4. Turning movements at the Nelson Bay Road /Port Stephens Drive roundabout, including heavy vehicles, operate well.
5. Nelson Bay Road carries a combined (two-way) volume of around 20,000 vehicles (19945) on weekdays.
6. The AM peak weekday westbound traffic flow was recorded at around 7 AM and 925 vph in two lanes.
7. The corresponding PM westbound peak was recorded around 4 PM and 740 vph in two lanes.

8. The 85th percentile speed was recorded as 82.5 kph (Noting the posted speed limit is 80 kph)
9. There are a number of U-turn facilities provided along Nelson Bay Road, alternating between small vehicle facilities, and U-turn bays suitable for larger vehicles (buses and trucks)
10. Observations at the Nelson Bay Road / Port Stephens Road roundabout indicate it currently operates at good levels of service at peak times. (Austroads 2009)

12.2 The Proposal

Traffic Generation In relation to expected truck movements for the project has been assumed at a maximum of 40 two-way movements per day. (i.e. 40 movements in and 40 movement out of the site.) This equates to advice on planned truck payloads of 1400 tonnes per day, based on the proposed use of a 35 tonne (~ 22 cubic metre) truck and dog combination. This equates to 55 full days of activity over a year. It may be the demands are spread over more days, but this represents the assumed (planned) maximum movements that could occur on any one day.

With the turning volumes assumed accessing the site at around 40 truck movements per day plus some light traffic, over an 11 hour operating day (7am to 6pm Monday to Friday, 8am to 1am Saturdays) this would be in the order of 5 movements into the site in any one hour assuming a uniform flow profile (4 trucks and 1 car).

12.3 Potential Impacts

In comparison with the peak westbound flow on Nelson Bay Road recorded in February 2018 at 925 vph, traffic generation associated with the proposed development represents only a 0.5% change in traffic volumes. Even doubling this flow would only represent around 1% of passing traffic flows.

In terms of determining the appropriate site access treatment for the proposed development it will be the through traffic component that determines the type of treatment required.

A traffic flow of 925 vph falls within the Level of Service 'B' range (900 to 1400 vph), at just over the highest category Level of Service 'A' threshold of 900 vph.

Even if a 3% per annum background growth figure is added to this base flow for 10 years, a NSW Roads and Maritime requirement in all traffic impact assessment work in NSW (i.e. 30% over the base flows) the resulting flow of around 1200 vph still falls within the LoS 'B' range for urban road peak hour flows.

Road capacity is not considered an issue for the project proposal. A BAsic Left turn treatment (BAL) is considered an appropriate turn treatment according to Austroads.

12.4 Mitigation Measures

The traffic assessment report concludes that the local road network is readily able to accommodate traffic generated by the proposed development and that the provision of a BAsic Left turn treatment (BAL) should be required, providing ingress to and egress from the site.

13 ENVIRONMENTAL IMPACT ASSESSMENT: LAND RESOURCES

An expert report addressing site geotechnical and groundwater characteristics and the impacts of the proposed development was undertaken by RCA Australia (**Appendix A**).

13.1 Existing Geological Environment

Reference to the New South Wales Zone 56 Seamless Geology version 1 Digital Dataset indicates that the site contains Quaternary age dune sand deposits.

The Port Stephens 1:100,000 Soil Landscape Series Sheet 9332 indicates that the majority of the site is situated in the Hawks Nest soil landscape (an Aeolian soil landscape) with the proposed sand extraction to the south situated in the Stockton Beach soil landscape.

The Hawks Nest soil landscape is noted to generally comprise stable, gently undulating, Holocene sand sheets and beach ridges.

The Stockton Beach soil landscape is noted to generally comprise beaches, foredunes and often extensive and unstable dunes and blowouts on Holocene marine and Aeolian sand. Very well-drained Calcareous Sands are expected in the sand dunes.

A subsurface investigation was undertaken to assess the soil and groundwater conditions across the site. The investigation comprised the drilling of bores up to 12 metres deep, construction of groundwater monitoring wells, infiltration testing and laboratory testing of the soils for particle size distribution and presence of acid sulfate soils. Soils beneath the site comprise a quartzose aeolian sand profile.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. Groundwater was encountered at a depth of approximately 2m AHD. Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand extraction during wet climatic periods.

13.2 The Proposal

The proposed sand extraction operation will remove windblown sand to ground level only.

No significant excavation is proposed below ground level for the purposes of the site office/manager's residence.

13.3 Potential Impacts

Based on the results of the ASS testing, the proposed development is not expected to encounter actual acid sulfate (AAS) or potential acid sulfate soils (PASS).

No additional land resource impacts are anticipated.

13.4 Mitigation Measures

With regard to geotechnical stability of the batter associated with the sand mine, it is recommended that when the mine is not actively loading out that batters be limited to a maximum of 1.5H:1V and for long term stability against mass failure that the slopes be battered at a maximum 2H:1V.

14 ENVIRONMENTAL IMPACT ASSESSMENT: WASTE

A Site Waste Management Plan was prepared by Advitech Environmental (**Appendix H**).

14.1 Existing Environment

Waste disposal and recycling facilities are made available by Port Stephens Council.

14.2 The Proposal

From a waste generation/management perspective, the development is akin to a residency and is comparable to its neighbours along Nelson Bay Road.

The operations/activities proposed for the site will generate both one-off waste streams in the construction/development phase and ongoing waste streams.

Proposed operations/activities likely to contribute to the waste generation at the site include:

- Green waste generated during site works and construction;
- Ongoing green waste arisings;
- Sand mining operations to prevent encroach of coastal dunes onto electricity distribution easement;
- Storage of mobile equipment and auxiliary equipment; and
- General domestic wastes including packaging waste.

14.3 Potential Impacts

14.3.1 Green Waste

Green waste from the sand quarry site is generated from the following sources:

Clearing vegetation for the construction of the machinery shed/caretakers residence/ site office, intersection upgrade and haul route realignment;

Removal of dead vegetation from within the sand extraction area; and

Continual upkeep of the vegetation surrounding the caretaker's residence and haul route.

The cleared area including the proposed building bush fire asset protect zone (APZ) covers approximately 10,000 m²; approximately 2,500 m² of this area is within the easement and is already cleared.

The following assumptions have been utilised in order to estimate the potential mass of green waste to be generated prior for the construction phase of the project:

It is estimated up to 100 trees will be removed from the 7,500 m² area;

The average diameter of each tree removed is 300 mm to 350 mm; and

The average height of each tree removed is 10 metres to 12 metres and weighs approximately 1,000 kg.

According to the 2010/2011 Waste Generation and Resource Recovery in Australia (WGGRA) database, the garden organics disposal rate is 50 kg/person/year. Assuming there will be between 1 and 2 residents living on-site, 50 - 100 kg/year (0.12 – 0.45 m³/year¹) of garden organic waste is likely to be generated. Given, the land lot is approximately 13 hectares, the anticipated volume of garden organic waste is readily managed onsite.

14.3.2 Construction Waste

Construction waste from the sand quarry site will be generated from the construction of the machinery shed/caretakers residence/site office, intersection upgrade and haul route realignment.

14.3.3 Blackwater and Greywater

Blackwater and greywater from the sand quarry site will be generated from the following sources:

- Blackwater from portable toilets provided during the construction of the caretaker's residence;
- Blackwater from toilets in the caretaker's residence; and
- Greywater from the bathroom, kitchen and laundry in the caretaker's residence.

The average water consumption of Australian residents is around 340 litres/person/day² (varying from a minimum of around 100 litres/person/day up to 900 litres/person/day in some areas) and much of this ultimately reports as blackwater and greywater.

The proposed development will not add any wastewater treatment demand on the local sewerage network.

14.3.4 Domestic Waste

Domestic waste from the sand quarry site is generated from the following sources:

- Household domestic waste from the caretaker's residence; and
- General waste from site office lunch room.

It is estimated approximately 600 kg/person/year of domestic waste will be produced (*Hunter Councils Waste Avoidance and Resource Recovery Strategy 2014-2021*). Assuming there will be 1-2 residents living onsite, 12 - 23 kg/week of waste will be generated. Approximately 52% of the waste generated is considered to be recyclable.

14.4 Mitigation Measures

14.4.1 Green Waste

Any vegetation removed for the construction of the caretaker's residence/site office/machinery shed; intersection upgrade and site access improvements will be mulched on site and spread for soil improvement purposes outside of the identified APZ.

Consequently, the estimated mass of mulch produced during the construction phase clearing operations is 100 tonnes. Once mulched and spread to a depth of around 100 mm, this quantity of mulch would be spread over an area of approximately 3,000 m² on the site as a one-off soil improvement activity.

It is anticipated that a maximum of 100 kg/year (0.45 m³/year) of green waste will be generated and managed onsite. If generated during a single pruning/garden maintenance event, this quantity would cover 50 m² of garden area with mulch to a depth of only 9 mm per annum.

It should be noted that two on call clean ups of bulky waste and/or green waste and monthly green waste drop-off services are also available each year if required for residents in the Port Stephens local government area.

14.4.2 Construction Waste

A nominated contractor/builder will be responsible for the construction of the machinery shed/caretakers residence/site office. The construction waste management is managed by the nominated contractor/builder. It is expected the contractor will consider the following measures:

- Ordering the right quantities of materials (Purchasing Policy);
- Prefabrication of materials;
- Re-using formwork;
- Modular construction and basic designs to reduce the need for off-cuts;
- Minimising site disturbance and limiting unnecessary excavation;
- Careful source-separation of off-cuts to facilitate re-use, resale or efficient recycling;
- Choice of landscaping to reduce green waste outside of the designated APZ area; and
- Co-ordination and sequencing of various trades.

The following assumptions have been utilised in order to estimate the potential mass of construction waste to be generated during the construction phase of the project:

- It is estimated approximately 2 – 20% of all materials ordered will end up as waste materials (2.5% will be used for this estimate given much of the construction material mass will be the concrete slab(s) and prefabricated steel sections, etc.) (WALGA, 2014);
- The floor area for the residence and the machinery shed combined is to be 800 m²; and
- The mass of single storey domestic type constructions (including foundations) is approximately 1,000 kg/m² of floor area.

The total mass of waste construction materials to be delivered to the Port Stephens Resource Recovery Centre is therefore estimated to be around 20 tonnes.

A minor quantity of incidental construction waste (labels, plastic bags, fixture packaging, cardboard boxes, etc) will also be generated. This will be deposited into an on-site skip bin (to be collected by a contracted bin hire company).

14.4.3 Blackwater and Greywater

All black water produced from portable toilets during the construction operations will be collected by a hired contractor on a regular basis.

The caretaker's residence will have an on-site septic system to accommodate any blackwater and greywater produced. Effluent (treated wastewater) from septic tanks will be released onto the property through absorption trenches. The septic system will be regularly inspected by the resident and routinely emptied of sludge as required.

The septic tank system to be installed will be suitably sized to cater for all anticipated site activity.

14.4.4 Domestic Waste

All general and household wastes will be either disposed in the 240-litre red bin for weekly collection or recycled in the 240 or 360 litre yellow bin for fortnightly collection by Port Stephens Council.

It should be noted two on call clean ups of bulky waste and/or green waste are available each financial year for residences in the Port Stephens local government area.

15 ENVIRONMENTAL IMPACT ASSESSMENT: HAZARDS

A Bushfire Threat Assessment was prepared by Tattersall Lander (**Appendix I**).

No further hazard considerations are relevant to the proposed development.

15.1 Existing Environment

The site is located in the Port Stephens LGA, which is in the Greater Hunter District and has a Fire Danger Index rating (FDI) of 100.

There is significant vegetation within the site which, for bushfire assessment purposes, is designated as forest.

The subject site is accessed via Nelson Bay Road which is capable of carrying fully laden fire fighting vehicles, including tankers. The proposed development is to be accessed via an existing all-weather access road.

There is a secondary alternate access/egress for use in the event of a bush fire emergency; via the powerline easement.

15.2 The Proposal

The proposed development incorporates the following:

1. A 35 metre Asset Protection Zone (APZ) is to be constructed around the machinery shed/residence;
2. The machinery shed/residence is to be constructed to Bushfire Attack Level BAL-19 (AS3959-2009);
3. A rainwater tank with a minimum 20,000 litre capacity is to be installed in accordance with Planning for Bushfire (2006), with the following requirements:
 - the tank must be metal or concrete;
 - a 65mm Storz fitting with a metal gate or ball valve is to be fitted near the base of the tank;
 - all above ground taps and pipe work are to be metal;
 - a peripheral hardstand area is to be constructed to a dimension of at least 4 metres from the edge of the tank

- Static Water Supply signage is to be installed, one at the property entrance, and one adjacent to the tank, so that it is visible from the access track.
4. Site access is to be via an all-weather access road which is proposed to be 6 metres in width with a minimum 4 metre vertical clearance. This width negates the requirement for any passing bays. The existing site access will require minimal upgrading to achieve this standard.

Subject to the provision of these design features, the proposed development is Planning for Bushfire (2006) compliant.

15.3 Potential Impacts

Sufficient design measures are proposed to be incorporated into the proposed development such that it is Planning for Bushfire (2006) compliant.

The proposed development will not adversely impact the bushfire threat to the site or to the locality.

15.4 Mitigation Measures

The bushfire threat assessment has concluded that the proposed development is compliant with Planning for Bush Fire Protection.

In order to minimise any threat associated with bushfire ignition (e.g. grinding, welding, refuelling etc.), all such associated activities are to be carried out within the site ancillary building.

No further mitigation measures are required.

16 ENVIRONMENTAL IMPACT ASSESSMENT: VISUAL

A Visual Impact Assessment was prepared by Tattersall Lander (**Appendix J**).

16.1 Existing Environment

The majority of the site is heavily vegetated and relatively flat. **Error! Reference source not found.** clearly shows that the proposed sand extraction site and manager's residence/site office location are not visible from Nelson Bay Road or from eastern, north-eastern and western adjoining properties; vegetation clearly obscuring such views.

Long distance views to the sand dunes and electricity infrastructure (only) at the far southern extent of the site are available from sand dunes to the south, south-east and south-west.



Plate 16-1: View North-West from Distant Sand Dunes: 33kV Electricity Network in Background

16.2 The Proposal

The proposed development will result in an insignificant change to the existing visual environment of the site and the locality. Sand will be extracted from the

edge of the dune system and a site office/manager's residence constructed in a well-considered location.

16.3 Potential Impacts

The proposed sand extraction site and manager's residence/site office location are not visible from Nelson Bay Road or from eastern and western adjoining properties.

There will be no adverse visual impact from the proposed development onto Stockton Beach Dune System, as the sand is being removed from the back of the current barrier dune with battering to be constructed in accordance with the geotechnical assessment. The site office and manager's residence will be sheltered from view from the beach by the remainder of the sand dune that will not be extracted.

The Visual Impact Assessment (**Appendix J**) clearly illustrates the insignificant potential visual impact of the proposed development in further detail.

16.4 Mitigation Measures

The proposed siting, design and colour (neutral building tones) of the development are considered visually unobtrusive. No further mitigation measures are proposed.

17 ENVIRONMENTAL IMPACT ASSESSMENT: SOCIAL AND ECONOMIC CONSIDERATIONS

A Social Impact Assessment (SIA) with related economic considerations was prepared by Tattersall Lander (**Appendix K**).

17.1 Existing Environment

Anna Bay is a township and a bay in the Port Stephens local government area; situated between Newcastle and Nelson Bay. The town is immediately adjacent to the north-eastern end of Stockton Beach and provides one of the major entry points to the beach. The locality provides beaches and tourism in association with residential, commercial and rural uses.

A demographic profile of the locality which incorporates social and economic characteristics is provided within the SIA.

17.2 The Proposal

Sand from the proposed development site will be classified as VENM (Virgin Excavated Natural Material) and will be used for bulk filling of land and developments. The sand resource is intended for general construction and filling purposes in various locations; primarily Newcastle and the Hunter Valley.

The sand extraction will provide a cost-effective supply sand for the local and regional development industry.

The proposed operation will only source workers from the Port Stephens and local regional areas, so creating local sustainable jobs. The proposed sand mine provides an opportunity for local employment at Anna Bay and other local and regional businesses through the multiplier effect. The proposed sand extraction through the life of the mining operations will allow for the continued employment of local workers.

6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months. Similarly, 6 part-time employee positions will be required for internal road construction purposes for 2 months. 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site. The proposed sand extraction facility will contribute to the up-skilling of the local workforce in training and development of staff.

The approval of the sand extraction operation will see jobs generated for up to 30 years.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

17.3 Potential Impacts

A Public Meeting was held at the Anna Bay/Birubi Point Community Hall on 12 September, 2018 to discuss the proposed development. The SIA has identified a range of stakeholder considerations associated with the proposal.

Due to the limited physical nature of the proposed development (including requirements to remove sand under the electricity easement for Ausgrid maintenance purposes), the primary nature of discussion by the public has been centred on questions and comments rather than commentary by way of specific objection due to perception of adverse impacts.

17.4 Mitigation Measures

The SIA provides a response to the considerations and questions raised by the community at the Public Meeting (12 September, 2018) held to discuss the proposed development.

Relevant community and technical mitigation strategies are important to address the variety of considerations which have been raised by both the public and by other stakeholders.

The EIS incorporates a significant number of specific mitigation strategies in relation to the following considerations, as well as providing an associated Statement of Commitments:

- Traffic Impacts
- Ecological Impacts
- Noise and Vibration
- Air Quality

- Aboriginal Cultural Heritage

An important part of future dialogue with the community relates to ongoing monitoring. Monitoring programs are useful in establishing not only project developments, but also community concerns and how such considerations may or may not align with actual risks or perceived impacts.

The following measures are credible methods of ongoing community engagement and could be encouraged in this particular circumstance, subject particularly, to community demand for same:

- Creation of a Community Consultative Committee
- Dedicated phone hot lines for regulation, compliance and emergency matters
- Community information sessions
- Annual community reports
- Annual dialogue with neighbours: formal and informal

18 REHABILITATION

18.1 Final Post-Extraction Environment

An expert Geotechnical and Groundwater Investigation was commissioned for the proposed development and was prepared by RCA Australia (2018) (see **Appendix A**).

With regard to geotechnical stability of the batter associated with the sand mine, it is recommended that when the mine is not actively loading out that batters be limited to a maximum of 1.5H:1V and for long term stability against mass failure that the slopes be battered at a maximum 2H:1V. Final rehabilitation will ensure that slopes are battered for long term stability against mass failure.

The southern extent of the sand dune will be stabilised with relevant densities and types of spinifex grass species.

19 PROJECT JUSTIFICATION AND ALTERNATIVES

19.1 Project Justification

Schedule 2 of the Environmental Planning and Assessment Regulation, 2000 requires that an EIS includes the reasons justifying the carrying out of the development or activity in the manner proposed, having regard to biophysical economic and social considerations and the principles of ecologically sustainable development.

A proposed development can be justified if the socio-economic and environmental benefits outweigh any disadvantages; and the overall impacts are acceptable to the community in terms of the principles of ecologically sustainable development.

There is a requirement to maintain the electrical easement free of obstruction. Southerly winds are resulting in continuous sand deposition, causing an ongoing issue with the ability to maintain the easement. The accumulation of these sands is a primary electricity maintenance consideration, and also a potential safety issue.

The removal of the sand from this easement is able to be undertaken on behalf of Ausgrid without consent, however, removal of sand south of this easement requires consent. Removal of sand to the south of the Ausgrid easement, provides an effective buffer to its accumulation within the easement.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

The proposed development is:

- Compliant with relevant state and local legislation and associated policies;
- Able to be satisfactorily resourced with necessary services and infrastructure without causing adverse impacts to those services and networks;
- Able to require the provision of biodiversity offsets;
- Able to accommodate requirements to provide satisfactory acoustic and air quality outcomes; and
- At its completion, accommodate satisfactory rehabilitation of the sand dune.

The proposed operation will only source workers from the Port Stephens and local regional areas, so creating local sustainable jobs. The proposed sand mine provides an opportunity for local employment at Anna Bay and other local and regional businesses through the multiplier effect. The proposed sand extraction through the life of the mining operations will allow for the continued employment of local workers.

6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months. Similarly, 6 part-time employee positions will be required for internal road construction purposes for 2 months. 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site. The proposed sand extraction facility will contribute to the up-skilling of the local workforce in training and development of staff.

The approval of the sand extraction operation will see jobs generated for up to 30 years.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

The EIS demonstrates that through the implementation of the recommended mitigation measures, the proposal will have no significant impacts.

The project can be implemented with minimal adverse socio-economic and environmental impacts as demonstrated throughout the EIS. The proposed development is consistent with the principles of ecologically sustainable development and social and intergenerational equity.

Approval of the project is warranted because of these factors as well as on the basis of maintenance of the existing electricity easement, the efficient utilisation of available existing resources and the overall economic benefits to local, regional and State economies.

19.2 Project Alternatives

The alternatives to this proposal are:

- Do nothing and allow the sand to accumulate – this alternative is not viable due to maintenance efficiency and safety issues
- Allow Ausgrid to remove the sand within the easement – this alternative is not ideal as it consumes Ausgrid resources unnecessarily.

Allowing the proposal as a commercial enterprise means that it is in the interests of the proponent to actively monitor the situation and remove sand at the appropriate times.

20 STATEMENT OF COMMITMENTS

Table 20-1: Project Statement of Commitments

Issue	Project Commitment	
Water		In order to protect groundwater, all refuelling and servicing of equipment will be undertaken within the site office structure on an impervious surface.
		Potable water will be collected in rainwater tanks connected to the site office/manager's residence and reused on site.
Noise	Construction Phase	Early and ongoing communication with potentially affected receivers to inform of the proposed works, duration and potential for noise.
		Training workers to minimise noise by avoiding shouting; minimising slamming vehicle doors; avoiding the use of radios or stereos outdoors where neighbours can be affected.
		Keeping truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices.
		Avoiding operating equipment simultaneously, where possible.
		Designing of the site to avoid the use of reverse alarms or employ the use of broadband alarms to reduce the occurrence of any annoying characteristics.
		Regular inspection and maintenance of equipment to ensure it is good working order.
		Placing as much distance possible between plant or equipment and other sensitive land uses.
		Scheduling works to occur when neighbours are not present, or during times of high background noise to provide masking or reduce the amount that the construction noise intrudes above the background.
		If noise complaints are received during the construction period, noise monitoring may be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.
	Operational Phase	Internal vehicle movements will be restricted to four heavy vehicles in any one hour of the day.
		Operations will only occur between the hours of 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays.
		Vegetation mulching will be undertaken during periods of higher background noise levels, identified as the periods before 8:00am and after 3:00 pm.
		Temporary barriers or local topography may be used to maximise the shielding of the nearby sensitive receivers from vegetation mulching activities.
		Noise monitoring is to be carried out to establish the noise emission level of the facility at sensitive receivers and determine compliance. Noise monitoring is to be undertaken on a quarterly basis for the year of operation, with the frequency of noise monitoring reviewed each year afterwards.

		Noise monitoring will be carried out in response to a complaint and will be completed as soon as practically possible after the complaint. Where applicable, following any corrective action, monitoring will be repeated to confirm the effectiveness of any control measure implemented.
Air Quality	Construction Phase	Early and ongoing communication with potentially affected receivers will be undertaken to inform of the proposed works, duration and potential for dust.
		Keeping truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices.
		Placing as much distance possible between plant or equipment and other sensitive land uses.
		If air quality complaints are received during the construction period, monitoring will be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.
	Operational Phase	During sand extraction operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day.
		Operations will only occur between the hours of 7am and 6pm Monday to Friday and 8am to 1pm on Saturdays.
		Implementation of an Air Quality Management Plan.
		If air quality complaints are received during the operational period, monitoring will be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.
Biodiversity	Biodiversity Offsets	Provision of Biodiversity Offsets in accordance with the BAM Credit Summary Report



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011027/BAAS17074/19/00011032	12287_20180601_AnnaBay_BDA R	30/08/2019
Assessor Name	Report Created	BAM Data version *
Ben Ellis	03/09/2019	13
Assessor Number	BAM Case Status	Date Finalised
BAAS18078	Open	To be finalised
Assessment Revision	Assessment Type	
3	Part 4 Developments (General)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAI	Ecosystem credits
Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula								
1	1648_DNG	6.1	1.1	0.25	High Sensitivity to Potential Gain	1.75		3
3	1648_Intact	6.4	5.7	0.25	High Sensitivity to Potential Gain	1.75		16

Assessment Id	Proposal Name	Page 1 of 2
00011027/BAAS17074/19/00011032	12287_20180601_AnnaBay_BDAR	



BAM Credit Summary Report

					Subtotal	19
Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion						
2	1204_Sparse	0.6	0.1	0.25	1.00	0
					Subtotal	0
					Total	19

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAIL	Species credits
<i>Diuris praecox</i> / Rough Doubletail (Flora)						
1648_DNG		6.1	1.12	0.25	1.5 False	3
1648_Intact		6.4	5.74	0.25	1.5 False	14
					Subtotal	17

Assessment Id

00011027/BAAS17074/19/00011032

Proposal Name

12287_20180601_AnnaBay_BDAR

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Where possible, construction works will avoid any impact to mature trees. Where unavoidable, works will minimise impacts to mature trees as follows:

	Construction Phase	- Clearing limits will be marked to prevent unnecessary clearing beyond the extent of the development footprint. Tree clearing and disturbance will be limited to the development site; - Where a tree must be disturbed priority will be given to pruning rather than clearing; and - The clearing of any trees will be undertaken in a manner that avoids damaging adjacent vegetation i.e. all trees should be felled into disturbed areas when feasible.
		Avoidance of any inadvertent impact to significant biodiversity values within the study area. Avoidance measures will include the following: - Appropriate signage, such as 'No Go Zone' or 'Environmental Protection Area', and exclusion fencing where relevant, will be installed where construction and operation is near significant biodiversity values i.e. location of Rough Doubletail population; - The location and significance of all ecological constraints within the study area will be made known to all contractors and staff. Annotated site plans will be displayed in the site office. Specific management measures required near constraints areas will be discussed in tool box talks and as part of all inductions; - All material stockpiles, vehicle parking and machinery storage will be located within cleared areas, areas proposed for clearing and in the site building as relevant and not in areas of native vegetation that are to be retained; - Implementation of temporary stormwater controls during construction to ensure that any discharges to drainage channels are consistent with existing conditions. These measures will conform to the specifications in Soils and Construction 'Blue Book' (Landcom, 2004) and will be maintained throughout the construction process until soil is successfully stabilised.
		A suitably qualified and experienced ecologist will be engaged to supervise removal of all significant habitat features as displayed in the BDAR and maintain a vegetation clearance register which will include the location, type and size of felled habitat trees and any contact with resident fauna. The supervising ecologist will work co-operatively with the plant operator to develop an adaptive clearance methodology that will minimise impacts to potential resident fauna whilst being conducted according to safe work methods. The adaptive clearance methodology will include the following key aspects: - Consultation with a suitably qualified ecologist to determine the best time to schedule clearance works to avoid nesting and breeding times for resident fauna - Preclearance surveys completed on the morning of any clearance works to determine if any nesting birds or canopy dwelling mammals are within the clearance footprint - Clearing utilising a 'soft felling' technique in which trees are 'nudged' by machinery and fauna given time to leave (overnight), before slowly felling the tree the following day - If fauna is identified within the proposed clearing area prior to clearing, or after 'nudging' the tree, operations will cease until the fauna has moved to a safe location or has been relocated. If fauna flee into a habitat tree demarcated for removal, this tree should also be nudged and left to fell until the following day - Any captured displaced fauna is to be relocated to the nearest area of appropriate habitat. If arboreal, the fauna is to be placed inside an artificial nest box and relocated. If the displaced fauna is nocturnal, relocation is to occur during dusk - All hollow logs and felled trees will be inspected by the ecologist before being relocated into areas of similar adjacent habitat

		All habitat tree felling activities and results are to be summarised in a tree clearance report by the supervising ecologist, including fauna injuries. All fauna sightings/captures will be recorded and uploaded to the NSW Wildlife Atlas.
		Habitat salvage within the development footprint will be undertaken prior to and during clearance activities, with the salvage methodology including the following key aspect: - Tree limbs containing natural hollows will be relocated and restored for use by fauna in the nearest adjacent area of similar habitat. A suitably qualified ecologist will be responsible for undertaking this requirement. Where natural hollows cannot be relocated, an artificial nest box will be installed by a suitably qualified ecologist onto a tree in the nearest adjacent area of similar habitat: - the nest boxes selected will be of a similar size and dimension to the hollow removed; and - nest boxes will be installed at a ratio of 1 nest box per hollow to be removed. Where removal of woody debris is required, dead trees and woody debris that are removed (diameter >10 cm) are to be placed in the nearest adjacent area. A suitably qualified ecologist will be responsible for undertaking this requirement.
	Operational Phase	Measures to reduce impact to resident fauna and flora within the study area during the operations phase will be implemented as follows: - Vehicle movement within the study area is to be restricted to operational hours - Vehicle speed within the study area is to be limited adjacent to habitat value to 10km/hr - No workers will be permitted to bring dogs onto the site - All food waste is to be disposed of in covered waste bins - A register of all disturbances to fauna caused during site operations is to be kept and updated by the site manager.
		Measures to afford additional protection to the Rough Doubletail population within the Ausgrid easement will be investigated. Consultation will be undertaken with Ausgrid in this regard. Ausgrid maintains ownership and responsibility for the easement and require periodic access for maintenance works. Measures could include permanent exclusion fencing, sedimentation barriers and spill management controls.
		Any animals injured during operations should be taken immediately to the Salamander Bay Veterinary Clinic (Open 9am-6pm weekdays) or equivalent for treatment. Any animals suspected of requiring rehabilitation will be delivered to an appropriate animal rescue and rehabilitation group such as Wildlife in Need of Care (Telephone 1300 946 295). The following measures will be implemented to prevent exotic plant material from entering/exiting the study area: - No imported material is to be permitted unless it has been inspected and confirmed to be free of dirt and mud which may contain weed seeds and vegetative material such as bulbs, root fragment, tubers or rhizomes; and - Vehicles and machinery are to be clean of soils, vegetation and seeds that have been brushed off or washed down prior to entering the study area.

		All employees and sub-contractors working within the study area will be educated on the identification of noxious weed species known to occur or with potential to occur. A protocol of reporting and mapping any sightings of these species will be developed and implemented by the site manager. Any high threat weeds known to occur within the site will be controlled in accordance with appropriate guidelines. Any artificial lighting used for security at night will be angled/directed downwards to avoid excessive light pollution affecting adjacent habitat.
Aboriginal Cultural Heritage		All workers are to be inducted into the site so that they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> and any conditions of any future consent with respect to Aboriginal heritage prior to and during and after construction activities. In the unlikely event of the identification of artefacts within the site, work in the surrounding area is to stop immediately. A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site. In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material. If the material is an Aboriginal object, the proponent will: • Notify the BCD's Enviroline and representatives of the RAPs; • Facilitate, in co-operation with the appropriate authorities and the RAPs, the recording and assessment of the finds; • Comply with any legal requirements and BCD directions; and • Develop and implement appropriate management strategies based on an assessment of significance of the finds. Recommencement of ground disturbance works may only resume once legal requirements are fulfilled. In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact must cease immediately. The location, including a 20 m curtilage, must be secured using barrier fencing to avoid further harm. The NSW Police must be contacted immediately. No further work is to be undertaken until the NSW Police provide written notification to proceed. If the skeletal remains are identified as Aboriginal, the proponent or their agent must notify the BCD's Enviroline and representatives of the RAPs. No works are to continue until the BCD provides written notification to the proponent or their agent. An Aboriginal Heritage Impact Permit may be required to manage human remains.
Historic Heritage		In the event that historical archaeological relics are unexpectedly exposed during excavation, ground disturbance works will stop in the affected area and a suitably qualified historical archaeologist will be engaged to assess the extent, condition and likely significance of the remains. Depending on the significance of the relics, notification of the discovery may be required in accordance with S.146 of the <i>Heritage Act 1977</i> and further approval may be required if impacts are proposed.
Traffic & Transport		A BASic Left turn treatment (BAL) will be constructed providing ingress to and egress from the site at Nelson Bay Road.

Land Resources	Sand batters will be limited to a maximum of 1.5H:1V during inactive sand extraction periods. For long term stability against mass failure and at the cessation of sand extraction, that the slopes will be battered at a maximum 2H:1V.	
Waste	Green Waste	Any vegetation removed for the construction of the site office/manager's residence, intersection upgrade and site access improvements will be mulched on site and spread for soil improvement purposes in appropriate locations.
	Construction Waste	The construction waste management will be managed by a nominated contractor/builder. In order to minimise costs and associated waste, the contractor will be required to consider the following measures: • Ordering the right quantities of materials (Purchasing Policy); • Prefabrication of materials; • Re-using formwork; • Modular construction and basic designs to reduce the need for off-cuts; • Minimising site disturbance and limiting unnecessary excavation; • Careful source-separation of off-cuts to facilitate re-use, resale or efficient recycling; and • Co-ordination and sequencing of various trades.
		The total mass of any waste construction materials will be delivered to the Port Stephens Resource Recovery Centre.
		All incidental construction waste (labels, plastic bags, fixture packaging, cardboard boxes, etc) will be deposited into an on-site skip bin to be collected by a contracted bin hire company.
	Blackwater and Greywater	All black water produced from portable toilets during the construction operations will be collected by a hired contractor on a regular basis.
		The site office/manager' residence will have an on-site septic system to accommodate any blackwater and greywater produced. Effluent (treated wastewater) from septic tanks will be released onto the property through absorption trenches. The septic system will be regularly inspected by the resident and routinely emptied of sludge as required.
	Domestic Waste	All general and household wastes will be either disposed in the 240-litre red bin for weekly collection or recycled in the 240 or 360 litre yellow bin for fortnightly collection by Port Stephens Council.
	Chemical Containers	Any chemical containers will be removed in accordance with approved methods.
Bushfire	An emergency management plan is to be developed and adopted to specify mandatory procedures in the event of a fire occurring on the site.	
	Onsite personnel are to be trained in the use of the fire extinguishers which will be made available at the site.	
	In order to minimise any threat associated with bushfire ignition (e.g. grinding, welding, refuelling etc.), all such associated activities are to be carried out within the site ancillary building.	

	Earth moving machinery is to be fitted with spark arresting mufflers.
	To prevent accidental ignition of vegetation, haul trucks are to have serviceable exhaust systems.
Visual	Siting, design and colour (neutral building tones) of the site office/manager's residence will be provided consistent with rural visual amenity and character of the locality.
Social	Subject to community demand for same: • Creation of a Community Consultative Committee • Dedicated phone hot lines for regulation, compliance and emergency matters • Community information sessions • Annual community reports • Annual dialogue with neighbours: formal and informal
Rehabilitation of Final Post- Extraction Sand Dune	Slopes will be battered for long term stability against mass failure at a maximum slope of 2H:1V. The southern extent of the sand dune will be stabilised with relevant densities and types of spinifex grass species.

21 CONCLUSION

There is a requirement to maintain the electrical easement free of obstruction. Southerly winds are resulting in continuous sand deposition, causing an ongoing issue with the ability to maintain the easement. The accumulation of these sands is a primary electricity maintenance consideration, and also a potential safety issue.

The removal of the sand from this easement is able to be undertaken on behalf of Ausgrid without consent, however, removal of sand south of this easement requires consent. Removal of sand to the south of the Ausgrid easement, provides an effective buffer to its accumulation within the easement.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the EIS has been prepared having regard to the impacts created at that level.

It is expected that through the implementation of the recommended mitigation measures, the proposal will have no significant impacts.

The project is consistent with the principles of ecologically sustainable development and social and intergenerational equity. The proposal is consistent with the objects of the *Environmental Planning & Assessment Act, 1979*. The proposed development can occur with minimal adverse socio-economic and environmental impacts as demonstrated throughout the EIS.

The proposed development enables satisfactory maintenance of the existing electricity easement. The proposed development also provides the efficient utilisation of available existing resources and presents overall economic benefits to local, regional and State economies.

Appendix A: Geotechnical and Groundwater Assessment

GEOTECHNICAL & GROUNDWATER INVESTIGATION

Proposed Sand Mine at 4226 Nelson Bay Road, Anna Bay

Prepared for Tattersall Lander

Prepared by RCA Australia

RCA ref 13280-201/2

August 2018



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APPENDIX D

LABORATORY RESULTS

RCA ref 13280-201/2

22 August 2018

Tattersall Lander
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Attention: Julie Wells

Geotechnical Engineering

Engineering Geology

Environmental Engineering

Hydrogeology

Construction Materials Testing

Environmental Monitoring

Sound & Vibration

Occupational Hygiene

**GEOTECHNICAL & GROUNDWATER INVESTIGATION
PROPOSED SAND MINE AT 4226 NELSON BAY ROAD, ANNA BAY**

1 SUMMARY

A proposed sand mine and ancillary development are proposed at 4226 Nelson Bay Road, Anna Bay.

The base of the proposed sand mine is at the approximate level of the existing ground surface at an existing electricity easement which runs approximately east to west across the property.

The sand dune system is advancing to the north towards the electricity easement at the south-eastern corner of the property. It is understood that sand mining is proposed to control the advancement of the dunes.

Ground levels vary from approximately RL9mAHD in the vicinity of the electricity easement up to approximately RL17mAHD in the vicinity of the proposed sand mine.

A subsurface investigation has been carried out to assess the soil and groundwater conditions across the site. The investigation comprised drilling of bores up to 12 m deep, construction of groundwater monitoring wells (fitting of one well with an automatic data logger), infiltration testing and laboratory testing of the soils for particle size distribution and presence of acid sulfate soils.

Soils beneath the site comprise a quartzose aeolian sand profile. Ground water was encountered at a depth corresponded to a level of approximately 2m AHD.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources.

Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand mine operational during extreme wet climatic periods.

Surface water infiltration testing yielded infiltration rates which varied from 4 to 5×10^{-4} m/sec.

The sand mining operations are not expected to encounter actual acid sulfate (AAS) nor potential acid sulfate soils (PASS).

In regard to geotechnical stability of batter associated with the sand mine, it is suggested that when the mine is not actively loading out that batters be limited to a maximum of 1.5H:1V and for long term stability against mass failure that the slopes be battered at a maximum 2H:1V.

2 INTRODUCTION

This report presents the findings of a geotechnical and groundwater investigation undertaken for a proposed sand mine at Lot 591 DP1191380, 4226 Nelson Bay Road, Anna Bay. The investigation was undertaken at the request of Julie Wells from Tattersall Lander on behalf of Hay Enterprises.

Ancillary development for the proposed sand mine at the site includes:

- A machinery shed/storage area and caretaker residence with amenities; and
- An upgraded 6m wide haul route from Nelson Bay Road realigned around the proposed machinery shed and caretaker residence.

This investigation has been undertaken to provide information to address a number of the Secretary's Environmental Assessment Requirements (SEARs) as requested by Tattersall Lander for the preparation of an Environmental Impact Statement (EIS) for the proposed sand mine. The SEARs to be addressed by RCA and the scope of work are shown in **Table 1**.

Table 1 *SEARs to be addressed by RCA and scope of work*

Secretary's Requirement	RCA scope of work
<i>A detailed consideration of maintenance of and adequate buffer between all excavations and the highest predicted groundwater table</i>	Details of the predicted highest groundwater level at the development site. RCA to drill piezometer borehole and install data logger to monitor groundwater depth below ground surface and predict maximum likely groundwater level.
<i>An assessment of potential impacts on the quality and quantity of existing surface and groundwater resources, including a detailed assessment of proposed water discharge quantities and quality against receiving water quality and flow objectives</i>	RCA to provide results of infiltration testing on soils.
<i>Potential impacts on acid sulfate soils including proposed management strategies</i>	RCA to drill and sample to confirm that acid sulfate soils conditions are not present in dune sands above RL9mAHD and liaise with Tattersall Lander to prepare an Acid Sulfate Management Plan if required.
<i>Potential impacts on landforms (topography), paying particular attention to the long-term geotechnical stability of any new landforms</i>	RCA to provide advice on suitable landform batter slopes for: - Long-term remediated batter slopes; - Working quarry staging batter slopes; for input into Tattersall Lander design.

This report includes the following:

- Site description.
- Description of fieldwork undertaken which includes drilling of boreholes, penetration testing, installation of instrumented groundwater piezometers and surface water infiltration testing.
- Description of the laboratory testing undertaken which comprise particle size distribution (PSD) and acid sulfate soil (ASS) testing.
- Details of the subsurface conditions encountered by way of logs of boreholes and results of surface water infiltration tests.
- The results of laboratory testing.
- The monitoring of the groundwater level with time.
- Assessment of maximum likely groundwater levels and fluctuations.

- Assessment of the presence of acid sulfate soils.
- Assessment of batter stability of the sand mine batters with respect to short-term and long-term applications.

For the purpose of the investigation the following was provided:

- Development plans drawn by Tattersall Lander comprising a locality sketch and drawings of the overall layout, staging plan, site section, adjoining mining operations and rehabilitation plan.
- A map and coordinates of the location of protected diuris praecox orchids provided by WILDTHING Environmental Consultants (a division of Tattersall Lander).

3 SITE DESCRIPTION

3.1 SITE DESCRIPTION

The proposed sand mine is to be situated in the sand dunes on the southern portion of 4226 Nelson Bay Road, Anna Bay south of an electricity transmission easement which runs approximately east to west across the property. The approximate location of the sand dune system is shown on the site location plan which is attached as **Drawing 1**, in **Appendix A** which also shows the approximate investigation test locations carried out for this report and the indicative location of proposed site developments (Machinery Shed, Caretakers Residence and Access).

The ground surface level in the vicinity of the proposed mine is variable. Away from the sand dunes the existing ground surface slopes across the site are gently undulating with slopes typically of the order of 0 to 5 degrees.

In the area of the electricity easement the ground surface has been modified and is roughly level at approximately RL 9mAHD. South of the electricity easement the ground surface levels rise abruptly at about 30 to 33 degrees up into the sand dunes to approximately RL17mAHD in the vicinity of the proposed sand mine. Slopes on top of the sand dune system are variable with slopes typically in the order of 0 to 10 degrees with localised sand dune faces having slopes up to 30 degrees.

Drainage across the site comprised infiltration drainage in the permeable sand.

Vegetation on the site at the time of the field investigation comprised mostly mature trees with visible treetops protruding through the inundating sand dune system. Some bitou bush was located atop the sand dune system. Grass and small plants including the protected diuris praecox orchid was found in the electricity transmission easement where the trees had been cleared.

Site photographs are shown on **Figure 1**.



Photograph 1 *Looking east atop the sand dune in the proposed sand mine initial area of operation.*



Photograph 2 *Looking west along the southern boundary where the vegetated area is being inundated with sand.*



Photograph 3 *Looking west along the electricity transmission easement from the eastern site boundary.*



Photograph 4 *Looking east across the sand dune slope.*



Photograph 5 *Looking south across the location of the proposed machinery shed and caretaker residence.*



Photograph 6 *Looking north across the location of the proposed machinery shed and caretaker residence and haul road.*

Figure 1 *Site Photographs taken on 30 January 2018.*

3.2 BACKGROUND

3.2.1 PROPOSED SAND MINE

As may be seen from Photographs 7 & 8 in **Figure 2** the sand dune system is advancing to the north towards the electricity easement at the south-eastern corner of the property. It is understood that sand mining is proposed to control the advancement of the dunes.



Figure 2 Aerial photographs showing the dynamic nature of the sand dune system—showing the northward advancement of the sand dunes during the time between the photographs.

It is understood that the body of dune sand currently proposed to be mined has a volume of approximately 37,000m³. It is also understood that the proposed sand extraction area may extend to the west and northeast of the current proposed extraction area in the future as the dune system advances.

3.3 SOIL LANDSCAPE, GEOLOGICAL AND HYDROGEOLOGICAL SETTING

3.3.1 GEOLOGICAL SETTING

Reference to the New South Wales Zone 56 Seamless Geology, version 1 [Digital Dataset] (Ref [1]) shows the site to overlay Quaternary age dune sand deposits.

3.3.2 SOIL LANDSCAPE AND ACID SULFATE RISK MAPS

The Port Stephens 1:100,000 Soil Landscape Series Sheet 9332 indicates that the majority of the site is situated in the Hawks Nest soil landscape (an Aeolian soil landscape) with the proposed sand mine to the south situated in the Stockton Beach soil landscape.

The Hawks Nest soil landscape is noted to generally comprise stable, gently undulating, Holocene sand sheets and beach ridges.

The Stockton Beach soil landscape is noted to generally comprise beaches, foredunes and often extensive and unstable dunes and blowouts on Holocene marine and Aeolian sand. Very well-drained Calcareous Sands are expected in the sand dunes.

The Morna Point Acid Sulfate Soil Risk Map published by the Department of Land and Water Conservation indicates that there is a low probability of the occurrence of acid sulfate soil materials at depths greater than 3m below the ground surface in the areas

from which sand extraction is proposed. It is noted however that lowlands to the west of the site associated with Tilligerry Creek estuary/ flood plain have a well-known acid sulfate setting.

3.3.3 HYDROGEOLOGICAL SETTING

The site overlies part of the North Stockton sand beds and forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources.

The sand aquifer extends from the mouth of the Hunter River in the south to Anna Bay in the north and is bounded by the Newcastle Bight/Tasman Sea in the east and the Tilligerry Creek estuary and flood plains in the west. **Figure 3** presents a schematic cross-section of the geological/hydrogeological conceptual model of the site and its environs.

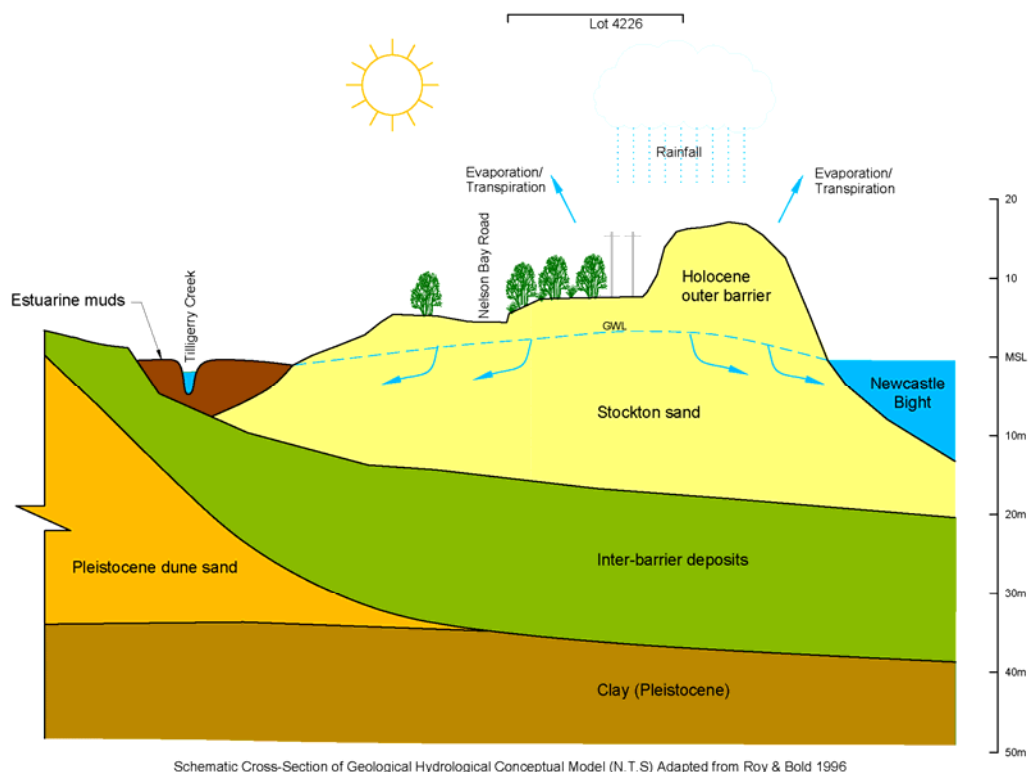


Figure 3 Schematic Cross-section of Geological/Hydrogeological Conceptual Model (adapted with modification from Ref [2])

The groundwater beneath the coastal dune system forms a groundwater divide between the ocean and Tilligerry Creek. Groundwater recharge is primarily from rainfall infiltrating the dune system and discharges by evapotranspiration and from groundwater discharge down gradient to the ocean and tidal estuary/ floodplain drains.

There are a number of licenced water works (wells) within about 0.5km of the site on the Department of Industries, Office of Water (OoW) data site. These include the following:

- GW047490 adjacent to Jessie Road south of the intersection with Nelson Bay Road. The OoW work sheet record this to be a local government owned bore with a standing groundwater depth of 6.1m.
- GW079407/GW079408 approximately 0.5km along the electricity easement west of the boundary of Lot 4226. No details are contained on the OoW work sheets apart from the installation being owned by Hunter Water ref Sk9593b.
- GW079138/GW079370 approximately 0.35km along the electricity easement east of the boundary of Lot 4226. No details are contained on the OoW work sheets apart from the installation being owned by Hunter Water ref BL215A.

The nearest bore on the DIP OoW database which contains monitoring results is GW080359 also referenced as GW800083_2 and Anna Bay Public School bore 3 located approximately 3km east of the site. A plot of water depth variations contained in the data base is shown on **Figure 4**.

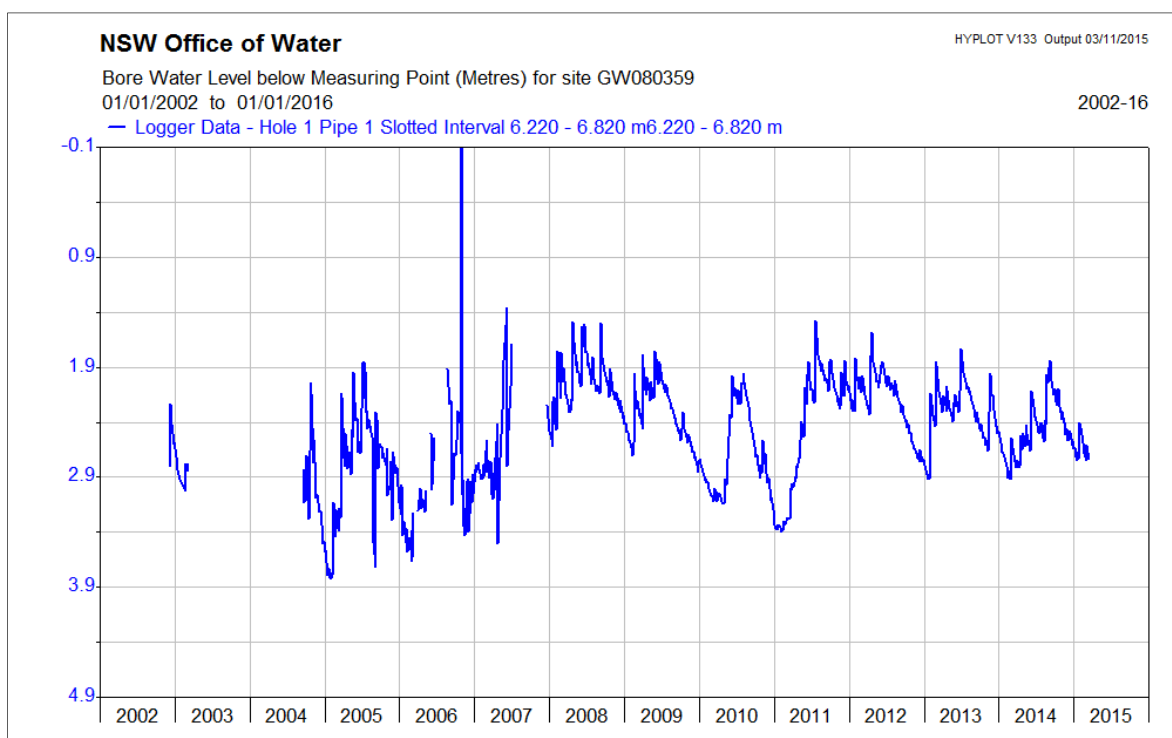


Figure 4 Plot of water depth in GW080359 (copied from OoW database) from 2002 to 2015

The spread sheet that accompanies the plot in the OoW data set indicates that the water level was deepest at 3.816m in earlier 2005 and spiked to 0.535m/0.498m on the 28/29 October 2006. The resulting maximum water level fluctuation is 3.318m from the lowest record over the period for which there is data. It is noted however that the rainfall records of stations (see **Figure 5** as an example) in the vicinity of the site do not record the occurrence of a significant rainfall event. Accordingly the cause of the spike is not known.

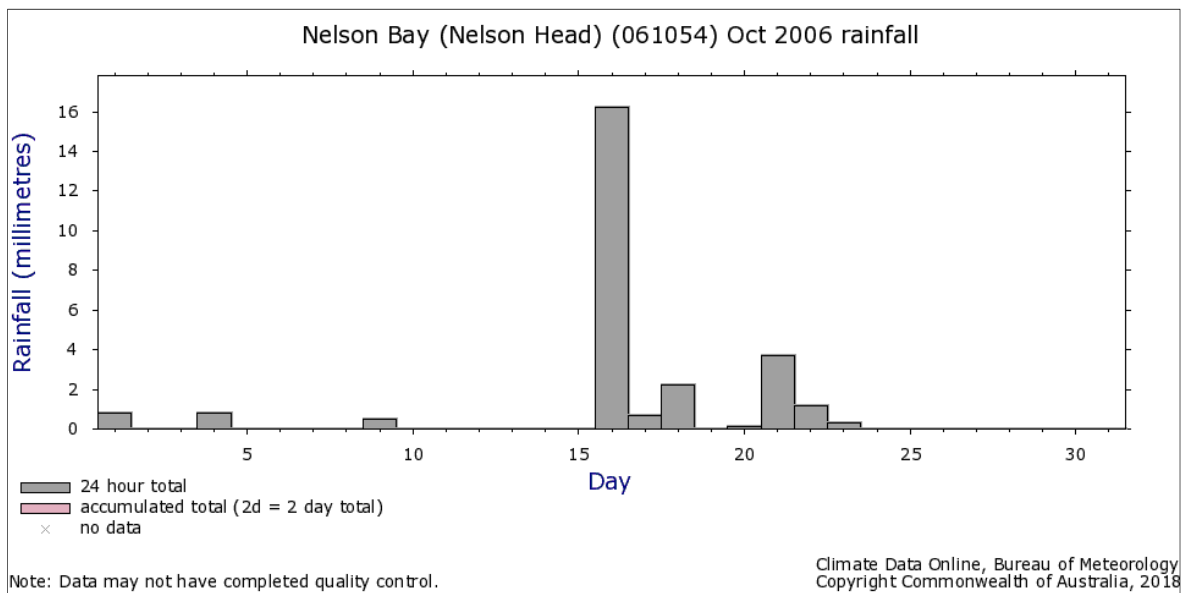


Figure 5 Daily Rainfall Nelson Bay October 2006 from BOM site

With reference to **Figure 4** it may be seen that in the absence of the spike in late 2006 the groundwater surface appears to have varied up to 2.5m in depth over the years of monitoring for which data is available.

Hunter Water (HW) have supplied monitoring information on the North Stockton network of monitoring bores including SK9593b and BL215A which as noted above lie to the west and east of the site, respectively.

The monitoring results are presented on **Figure 6**.

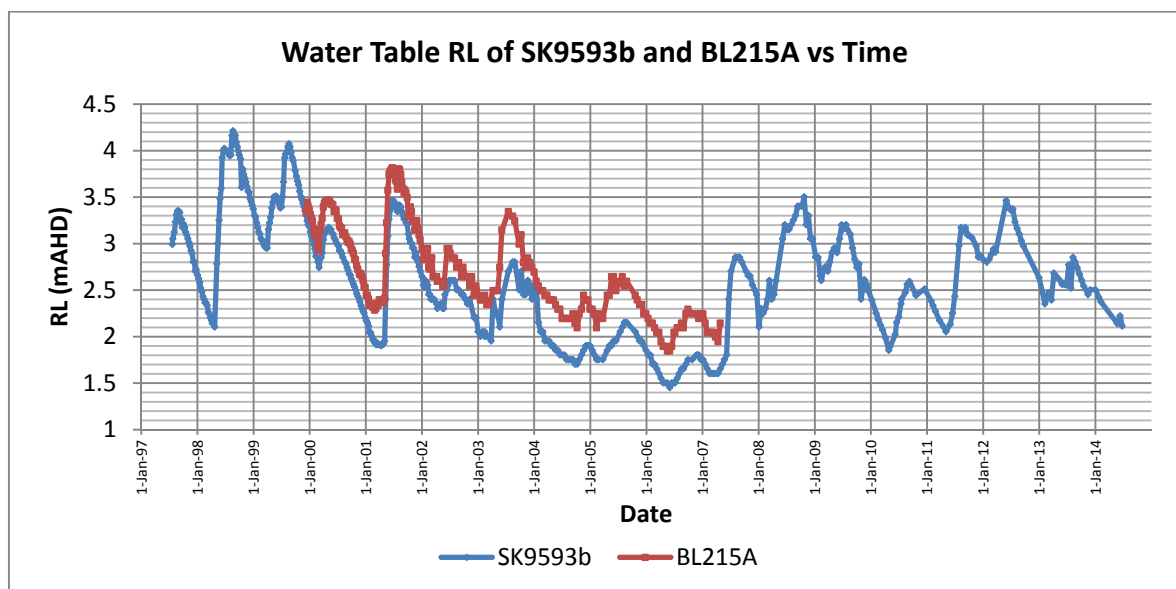


Figure 6 Plot of groundwater level monitoring data at SK9593b and BL215A (Hunter Water data)

It is noted that HW no longer monitors these sites and that the above is a complete data set apart from the removal of erroneous readings.

It may be seen from the **Figure 6** that the maximum variation in water level is approximately 2.8m.

4 FIELD AND LABORATORY INVESTIGATION

4.1 INVESTIGATION FIELDWORK

Field investigation was carried out on 23, 30 January 2018 and 2, 5, 12 February 2018 and involved the following:

- A visual appraisal and mapping of site conditions and features.
- Drilling, sampling and logging of five (5) hand auger bores (HA1 to HA5) to depths ranging from 0.95m to 6.0m.
- Dynamic penetrometer testing at 5 locations adjacent to the hand auger boreholes.
- Drilling, sampling and logging of two (2) boreholes (BH6 & BH7) to 12.0m. The boreholes were completed by a track mounted drilling rig using hollow flight augers.
- Installation of two (2) 50mm diameter standpipe piezometers (PZ1 in BH7 & PZ2 in BH6) to depths ranging from 11.60 to 11.70m. The piezometers were installed by a licenced water well driller from Total Drilling.
- Installation of an automatic down-hole data logger (HOBO) in one piezometer (BH7/PZ1). The data logger was set to read at 0.5hr intervals.
- Conducting four (4) in situ infiltration tests (INF1 To INF4) using double ring infiltrometer methodology.

The approximate test locations together with site features are shown on the site layout drawing provided by Tattersall Lander which is attached as **Drawing 1**, in **Appendix A**. The location and level of the test sites have not been located by survey.

Engineering logs of the subsurface conditions encountered in the hand auger bores and boreholes are presented in **Appendix B** along with piezometer diagrams and explanation sheets.

Double ring infiltrometer test reports are presented in **Appendix C**.

Photographs of selected investigation locations are shown below on Photographs 9 to 16 in **Figure 7**.



Photograph 9 *Hand auger borehole location atop the sand dune system at HA4.*



Photograph 10 *Drilling of hand auger HA3 atop the sand dune system.*



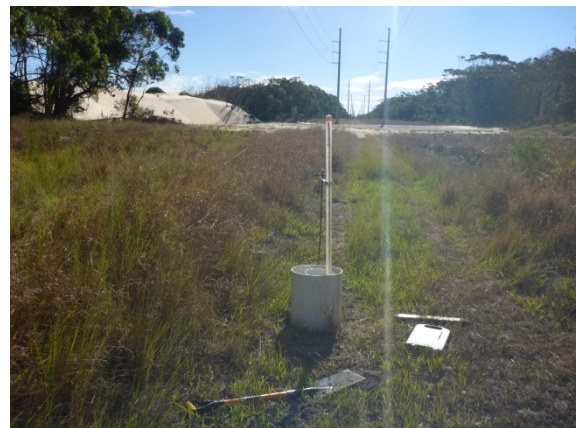
Photograph 11 *Borehole drilling at the location of BH6/PZ2.*



Photograph 12 *Installed Piezometer PZ1 at the location of BH7.*



Photograph 13 *Double ring infiltrometer apparatus set up at location INF1.*



Photograph 14 *Double ring infiltrometer apparatus set up at location INF2.*



Photograph 15 Double ring infiltrometer apparatus set up at location INF3.

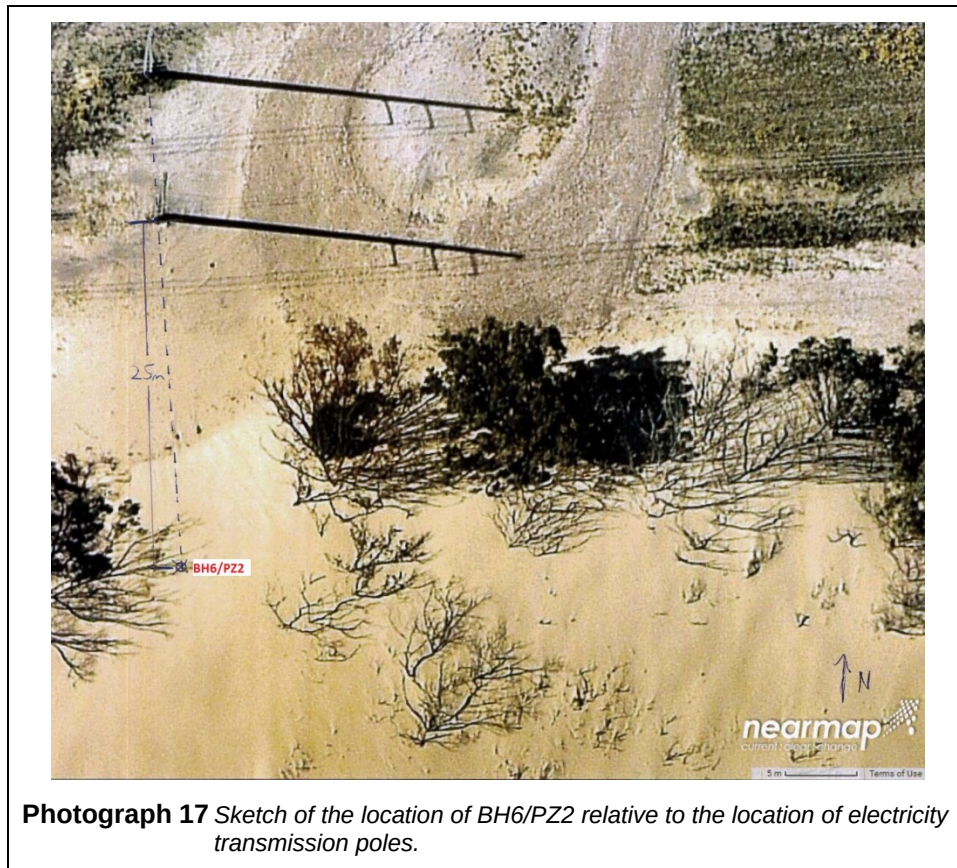


Photograph 16 Double ring infiltrometer apparatus set up at location INF4.

Figure 7 Photographs of selected fieldwork test locations

4.2 MONITORING WELL LOCATIONS

As noted above groundwater monitoring wells PZ1 and PZ2 were installed at the locations of BH7 and BH6 respectively. PZ1 is fitted with an automatic down-hole data logger taking readings of air and water pressure at half hour intervals and is finished above ground level within a lockable, galvanised steel monument. The groundwater monitoring well PZ2 was installed where heavy machinery is likely to traffic during the operation of the sand mine and is finished 0.3m below ground level with a concrete encased gaiter cover. PZ2 was installed as a precautionary measure; in case of damage to or the vandalism of PZ1 prior to the completion of the requirement for groundwater monitoring. The location of PZ2 is 25.0m from the closest edge of the electricity transmission pole on an imaginary line extending through the centre of both electricity transmission poles, as shown in **Photograph 17**.



4.3 LABORATORY TESTING

Laboratory testing comprised the following:

- Four (4) particle size distribution (PSD) tests on samples of sand from the proposed sand mine area of operation.
- Nine (9) acid sulfate screening tests conducted on samples of sand from the area of operation and above and below the water table to assess the presence of acid sulfate soils. Three (3) samples were sent for chromium reducible sulphur (CRS) testing to determine the presence or otherwise of sulphides.

Details of the laboratory testing are shown on the laboratory test reports attached in **Appendix D** and the results of the laboratory testing are summarised in Section 4.2.

5 SUBSURFACE CONDITIONS

5.1 SUBSURFACE CONDITIONS ENCOUNTERED DURING INVESTIGATION

5.1.1 SOIL PROFILE

The subsurface conditions encountered in the bores drilled and hand augered across the site of the proposed sand mine are detailed on the attached bore and hand auger report log sheets. The depths noted on the borehole logs have been recorded relative to the existing ground surface at the borehole locations at the time of the field investigation. An indicative generalised section through the section of the site of interest is shown on **Drawing 2 in Appendix A**.

The subsurface conditions encountered in the hand augers atop the sand dune (HA3 and HA4) comprised aeolian, quartzose, fine to medium grained, pale yellow-white sand.

A plot of the dynamic penetration testing from the top of the dune sand at HA3 & HA4 is shown on **Figure 8** together with the interpreted relative density.

Dynamic penetrometer testing indicates that the density of the sand is generally medium dense in HA3 and varies from very loose to loose/medium dense with depth in HA4.

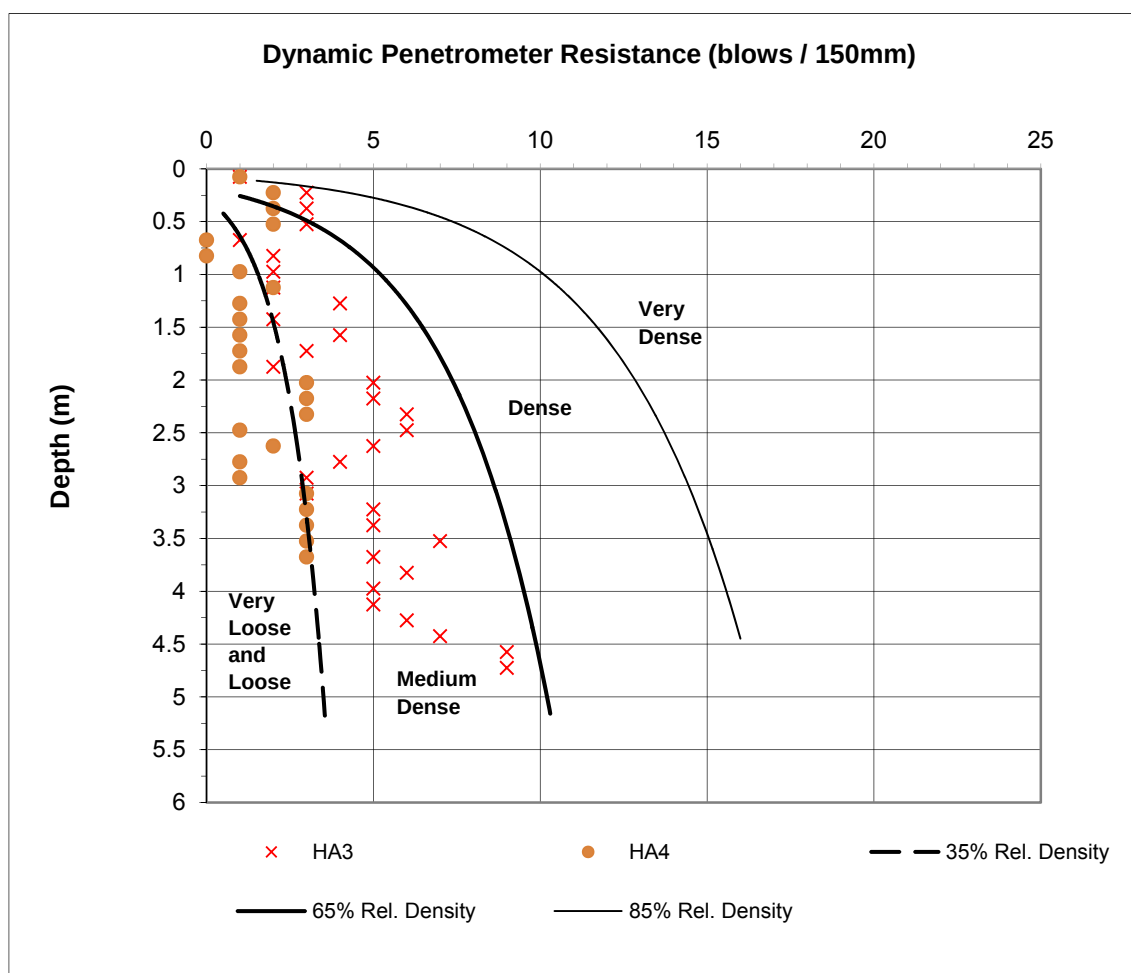


Figure 8 Plot of dynamic penetrometer resistance test carried out from the top of the sand dunes at the location of hand augers HA3 & HA4 (density curves from Ref [5])

The subsurface conditions encountered in the boreholes and hand augers drilled to the north of the dunes site can generally be summarised as follows:

- Topsoil (encountered in HA1, HA2, HA5, and BH7) comprising silty sand, fine to medium grained, grey, to a depth of 0.3m in the hand augers and 0.8m in BH7; overlying
- Aeolian sand, quartzose, fine to medium grained, encountered in all test holes to depths in excess of 12m in BH6 and BH7.

Dynamic penetrometer test results carried out at the location of HA 1, 2 & 5 are plotted on **Figure 9**.

With reference to **Figure 9** the density of the near surface sands is variable but generally medium dense (ie relative density index between 35% to 65%) or better below a depth of 0.7m.

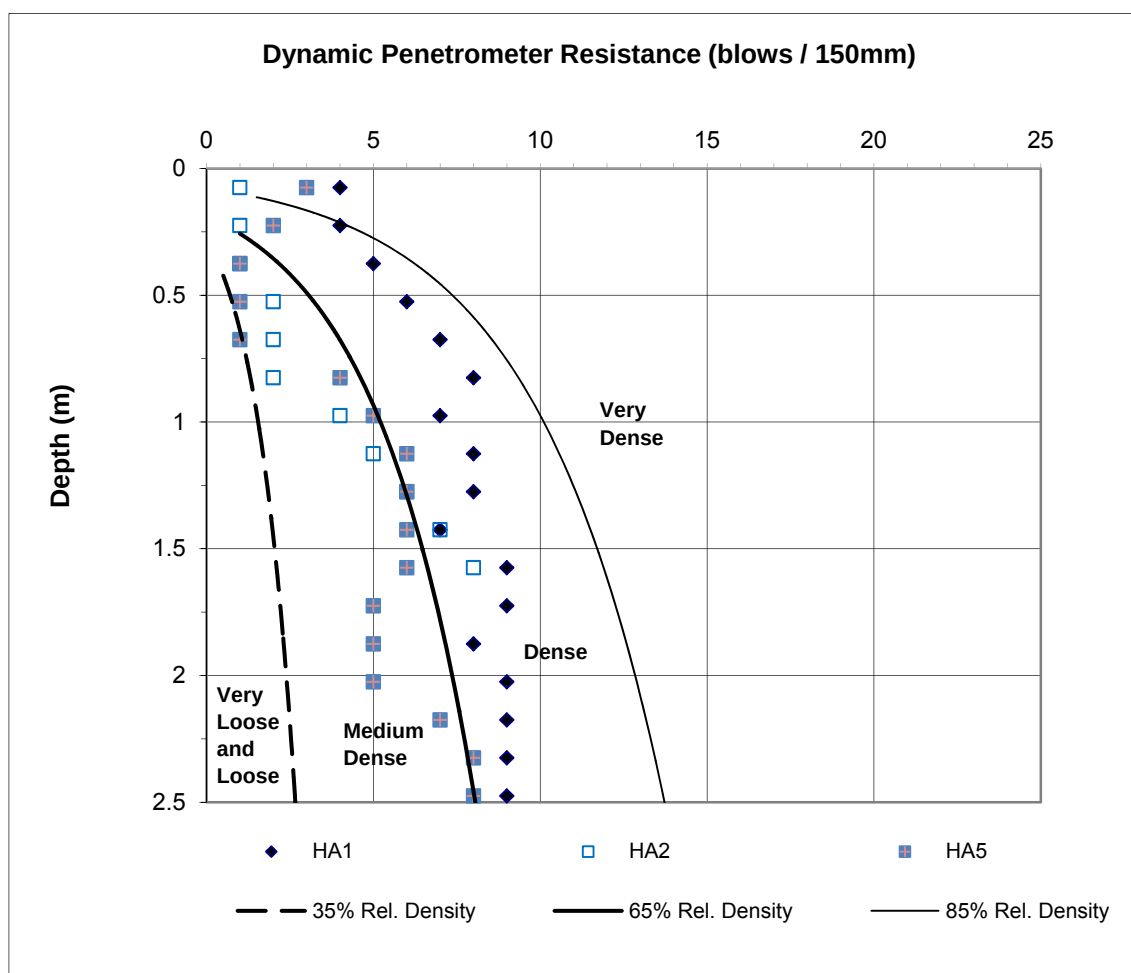


Figure 9 Plot of dynamic penetrometer resistance at the location of hand augers HA1, HA2 & HA5 (density curves from Ref [5])

The results of the Standard penetration testing (SPT) in BH6 & 7 are plotted on **Figure 10**. The results indicate that the sands are loose to medium dense in the upper zone and medium dense with depth.

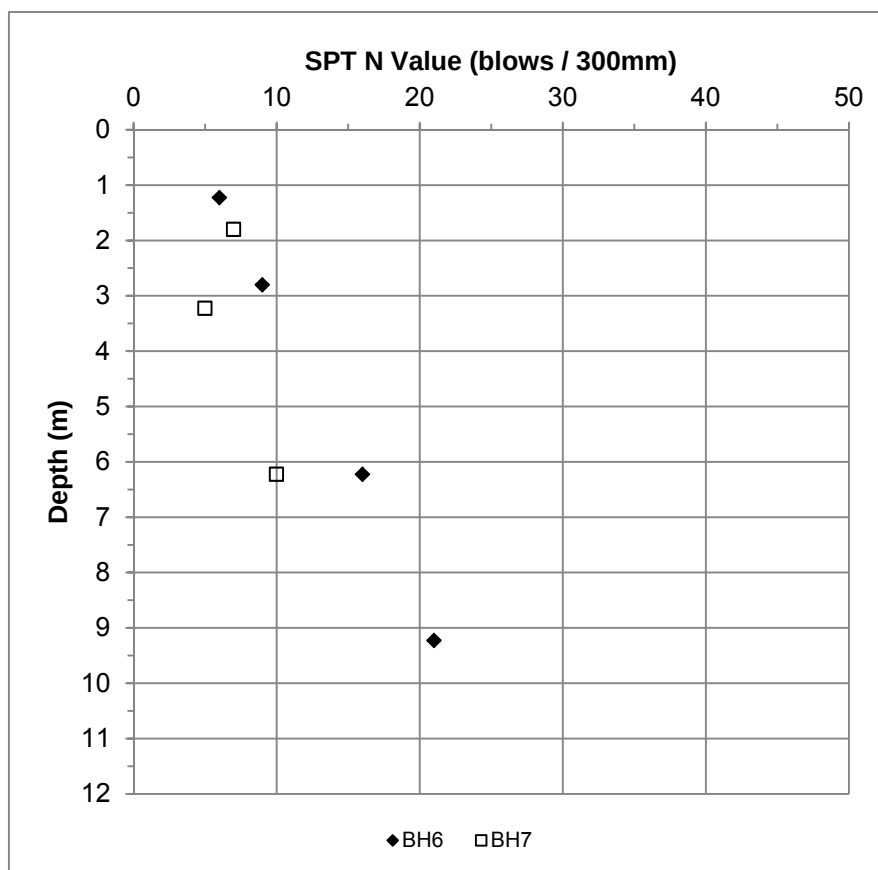


Figure 10 Summary of SPT testing in BH6 and BH7

5.1.2 GROUNDWATER LEVELS

The test locations have not been surveyed and all groundwater measurements are relative to the existing ground surface level. On 5 February 2018 groundwater was measured in PZ1 (in BH7) and PZ2 (in BH6) at depths of 7.45m and 6.30m below ground level respectively. With reference to **Drawing 2** in **Appendix A** the depths corresponded to a groundwater level of approximately 2m AHD.

The automatic down-hole data logger installed in BH7/PZ1 commenced taking readings on the 5 February 2018 and the data was downloaded on 28 February 2018 after some rainfall. The water level in PZ1 is recorded in **Figure 11** along with rainfall data from the Nelson Bay (Nelson Head) weather station approximately 12km away.

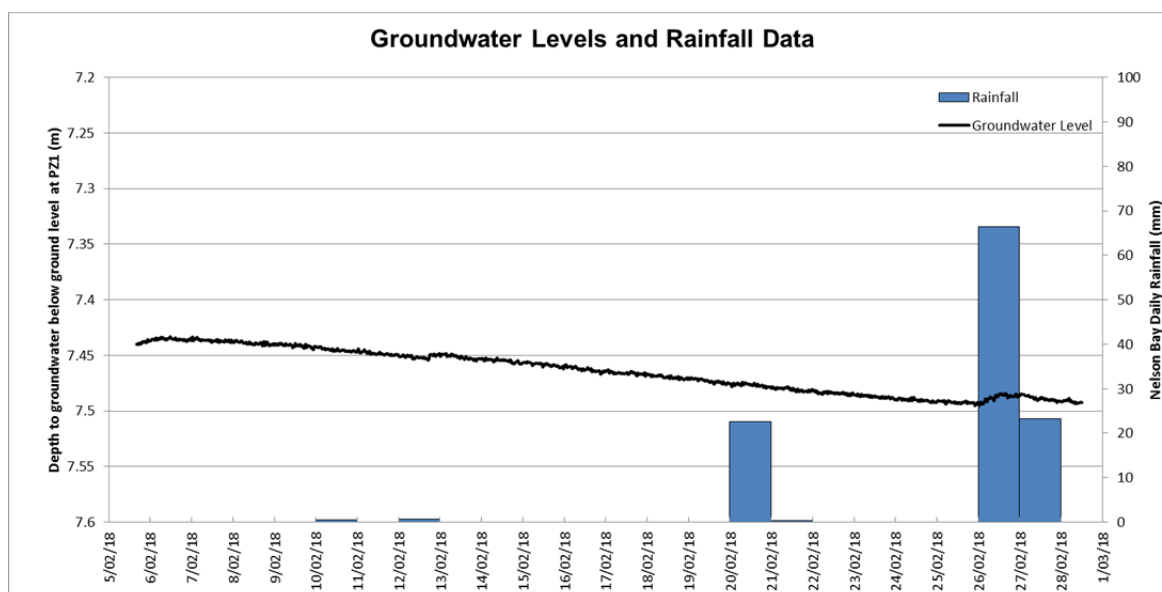


Figure 11 Continuous groundwater measurements throughout February 2018.

The depth to groundwater has steadily decreased by a total of approximately 50mm across the 23 days recorded. After significant rainfall on 26 February the groundwater level rose by 10mm however returned the next day to the downward trend.

5.1.3 INFILTRATION TEST RESULTS

Double ring infiltrometer testing was undertaken at four (4) locations (INF1 to INF4) across the site. Infiltrator rings were driven 100mm into the surface of the soil layer. The sites of the test were soaked with water for an approximate 30 minute period of time to establish saturated soil conditions before the testing was conducted.

Two tests were undertaken at each testing location using a 1.5L Mariotte tube. The double ring infiltrometer test reports are presented in **Appendix C** and are summarised in **Table 2**.

Table 2 Summary of In Situ Infiltration Rate Testing

Borehole	Depth of test (m)	Soil Type	Test Method	Average Infiltration Rate (m/s)
INF1	0.1	SAND, fine to medium grained	Double Ring Infiltrator – Constant Head	5.0×10^{-4}
INF2	0.1	SAND, fine to medium grained	Double Ring Infiltrator – Constant Head	4.0×10^{-4}
INF3	0.1	SAND, fine to medium grained	Double Ring Infiltrator – Constant Head	4.2×10^{-4}
INF4	0.1	SAND, fine to medium grained	Double Ring Infiltrator – Constant Head	4.1×10^{-4}

The measured infiltration rates as shown in **Table 2** indicate that the sand clean at the site has an approximate surface infiltration rate of 4.0×10^{-4} to 5.0×10^{-4} m/s.

The Hazen formula for permeability along with particle size distribution results suggests the dune sand has permeability of between 2×10^{-4} and 6×10^{-4} m/s.

5.2 LABORATORY TEST RESULTS

5.2.1 PARTICLE SIZE DISTRIBUTION TESTING RESULTS

Laboratory testing results are attached in **Appendix C** and are plotted and summarised in **Figure 12** and **Table 3** respectively.

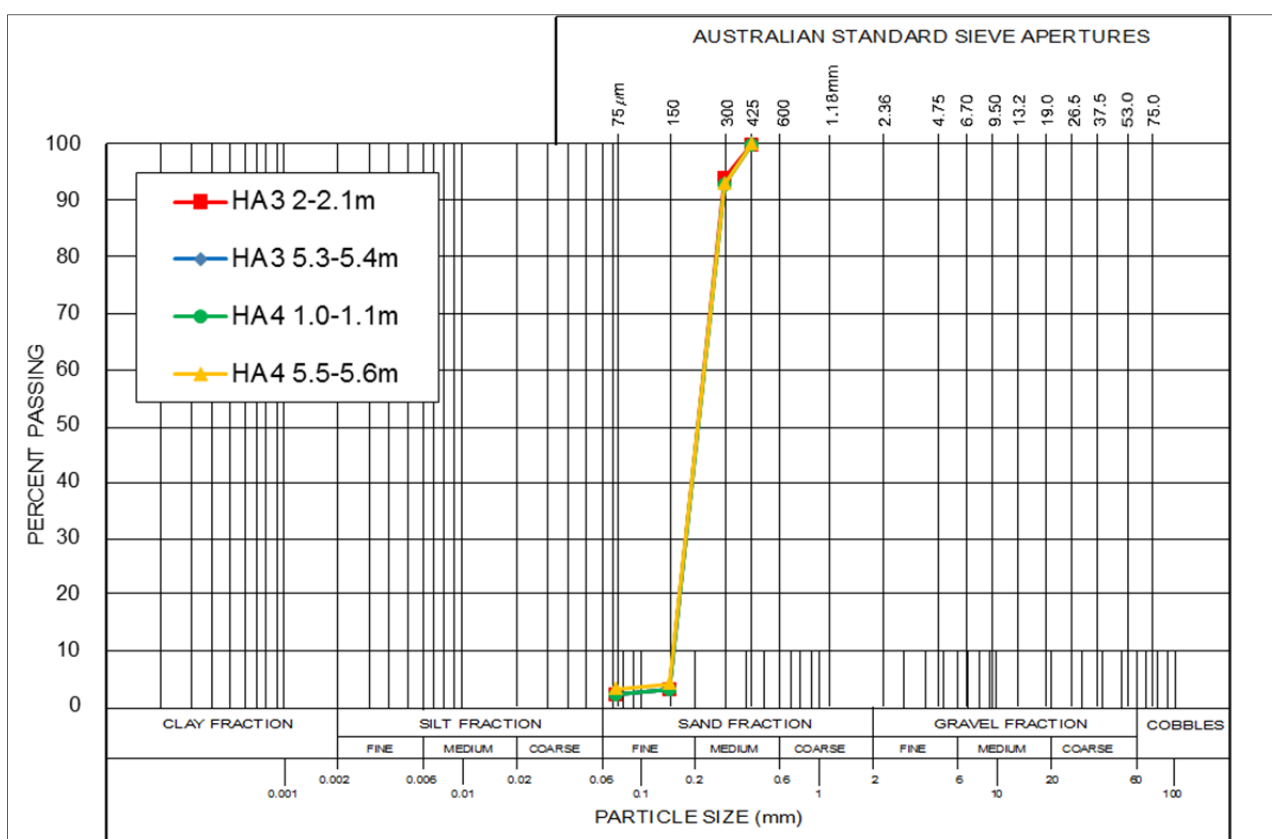


Figure 12 Particle Size Distribution Test Results

Table 3 Summary of Particle Size Distribution Testing Results

Borehole	Depth (m)	Soil Type	Particle Size Distribution		
			% Silt and Clay	% Sand	% Gravel
HA3	2.0-2.1	Aeolian SAND	2	98	0
HA3	5.3-5.4	Aeolian SAND	2	98	0
HA4	1.0-1.1	Aeolian SAND	2	98	0

HA4	5.5-5.6	Aeolian SAND	3	97	0
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The particle size distribution results indicate that the fine to medium grained dune sand is uniform in grain size with approximately ninety percent of the sand having a grain size between 0.15 and 0.30mm.

5.2.2 ACID SULFATE TEST RESULTS

The results of the acid sulfate screening testing on the samples of sand taken from the bores are shown on **Table 4**.

Table 4 Summary of ASS screening test results

	UNITS (m)	HA3 4.0-4.1	HA3 5.0-5.1	HA3 5.9-6.0	HA4 4.0-4.1	HA4 5.0-5.1	HA4 5.9-6.0	BH6 4.0-4.1	BH6 6-6.45	BH6 9-9.45
pH_F	pH unit	7.63	7.54	7.79	8.17	6.82	8.08	7.09	6.89	6.97
pH_{FOX}	pH unit	6.12	6.16	6.30	6.22	5.72	6.12	5.60	5.89	5.88
$pH_F - pH_{FOX}$	pH unit	1.51	1.38	1.49	1.95	1.1	1.96	1.49	1	1.09
Reaction Rate	-	1	1	1	1	1	1	1	1	1

pH_F - pH

pH_{FOX} - pH after oxidation

Reaction Rate Rate: 0 = No Reaction, 1 = Slight, 2 = Moderate, 3 = High, 4 = Very Vigorous

The screening test results indicate that the pH of the soils tested was greater than 4 and as such soils are not actual acid sulfate soils.

The screening testing indicate a drop on oxidation of greater than 1pH unit on oxidation but the resulting pH after oxidation is greater than 5 pH units and the reaction rate is slight indicating limited acid generation potential that the soils are unlikely to be potential acid sulfate soils. To confirm the limited acid potential of the sands four (4) chromium reducible sulphur analysis were carried out. The results are presented in **Appendix D**.

In summary, the % chromium reducible sulphur varied from 0.005% to 0.008% well below the trigger criteria of 0.03%S for a potential acid sulfate soil (PASS).

6 ADVICE ON REQUESTED SEARS

6.1 GROUNDWATER LEVELS

Groundwater monitoring has been ongoing for a limited period of time following a relatively dry period.

Available information on the maximum groundwater fluctuations likely in the sand beds included the following:

- Anna Bay Public School Bore 3 (discussed in section 2.3.3) indicates maximum groundwater surface level fluctuations over the years of monitoring presented (2002 to 2015) of 2.5m.

- The HW groundwater monitoring data for BL215A and SK9593b (monitoring wells closest to the site) indicates a maximum groundwater surface level fluctuation over the years monitored of approximately 2.8m.
- Ref [3], Figure 11 graphs groundwater levels between 1976 and 1987 for 2 long term monitoring wells in the Tomago sand beds which indicate maximum fluctuations of 2.5 to 3m for the period monitored.
- Ref [3] reports the monitoring of 7 wells at Salt Ash between July 2008 and October 2011 which fluctuated with climatic conditions typically from 1.0 to 1.7mAHD. The report considers the Hunter Water groundwater monitoring wells and modelling to include consideration of the effect of the heavy rainfall periods during 1990 and 2007 and reports a transient groundwater model run over the period from January 1997 to August 2011. The data and model indicate that the highest groundwater levels in the north Stockton aquifer were recorder in May to August 1999. Accordingly, the report finds that the August 1999 groundwater levels represent the maximum groundwater level. Modelling and the groundwater monitoring observation wells indicate a maximum fluctuation in groundwater level of 3.2m.

Based on the above groundwater surface level fluctuations (and the current relatively dry weather conditions) it is considered that the level of the groundwater surface may rise up to 3.5m above the current water depth as indicated in BH6/PZ2. Accordingly, it is expected that the highest probable water level would be 2.8m below the ground level at BH6/PZ2 in the proximity of the proposed sand mine operational area.

6.2 SURFACE WATER INFILTRATION TESTING

The results of the surface water infiltration testing are presented in Section 4.1.3. The test results yielded infiltration rates which varied from 4 to 5 x10⁻⁴m/sec.

The results are considered to be typical or representative values of infiltration rates for the clean, fine to medium grained sands at the site.

6.3 ACID SULFATE TESTING

Based on the results of the ASS testing, the sand mining operations are not expected to encounter actual acid sulfate (AAS) nor potential acid sulfate soils (PASS).

6.4 BATTER STABILITY AND SITE EARTHWORKS

6.4.1 ANGLE OF REPOSE OF THE DUNE SAND

The angle of repose of a sand batter is a measure of the shear strength friction angle of the sand in its loose state. With reference to **Figure 8** it may be seen that at least parts of the dune sand are composed of loose sand. Accordingly, it is considered that the angle of repose of the batter provides a good estimate of the shear strength friction angle of the sand.

The angle of repose was measured using a hand held inclinometer on an excavated sand dune to the south of the electricity power easement at site on 30 January 2018. The sand dune slope face was assessed to be at its critical angle of repose as disturbance of the batter surface caused surface flow and raveling on the batter. The measured angle of repose was approximately 30-33 degrees.

Based on the above and previous experience with similar materials the following Parameters have been adopted for stability assessment:

- Friction Angle (ϕ) – 33°
- Cohesion – 0
- Density (γ) – 19kN/m^3

6.4.2 BATTER STABILITY ANALYSIS FOR SHORT-TERM APPLICATIONS

It is understood that it is proposed to extract sand from the face of the dune system with an approximate height of 8m by excavator.

It is expected that the batter face in moist sand will be steeper than 1.5H:1V (35°) for short periods of time due to the capillary suction of the moisture between the sand particles imparting an additional shear strength by way of apparent cohesion.

In this state the batter is susceptible to a sudden collapse onto anything that is at the toe of the batter.

It is therefore suggested that when the sand mine is not actively loading out that the face should be battered down to an angle of no greater than 1.5H: 1V.

6.4.1 BATTER STABILITY ANALYSIS FOR LONG-TERM APPLICATIONS

It is understood that a stable batter slope is required for long term remediation of the sand mine batters on site at the boundary. In practical terms it is difficult to rehabilitate batter slopes in excess of 2H:1V.

A 2H:1V sand batter would have a factor of safety of 1.3 against sand raveling down the batter surface face. Due to the trivial nature of the movement a factor of safety of 1.3 is considered acceptable for this type of movement.

The factor of safety against mass rotational slumping of a 2H:1V batter slope extending behind the batter crest has been analyzed using commercially available stability program SlopeW and the parameters discussed in Section 5.4.1. The result is shown on **Figure 13**.

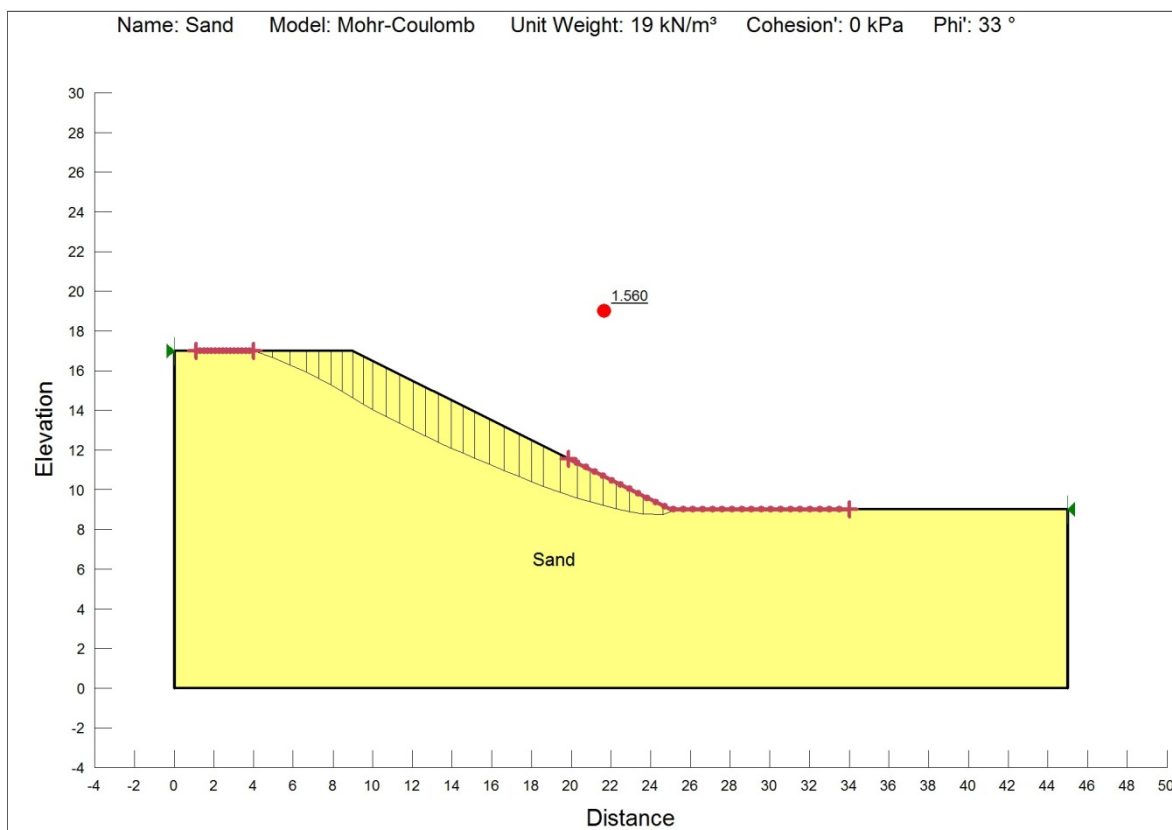


Figure 13 *Plot of Factor of safety against mass rotational slumping of 2H:1V batter slope*

The factor of safety against mass rotational slumping of a 2H:1V batter slope is in excess of 1.5 and this is considered acceptable for the proposed situation.

Based on the above it is suggested that from a geotechnical perspective a maximum batter slope of 2H:1V be adopted for the final landform batter.

7 LIMITATIONS

This report has been prepared for Tattersall Lander Pty Ltd in accordance with the agreement with RCA Australia (RCA). The services performed by RCA have been conducted in a manner consistent with that generally exercised by members of its profession and consulting practice.

This report has been prepared for the sole use of Tattersall Lander Pty Ltd for the specific purpose and the specific development described in the report. The report may not contain sufficient information for purposes or developments other than that described in the report or for parties other than Tattersall Lander Pty Ltd. This report shall only be presented in full and may not be used to support objectives other than those stated in the report without permission.

The information in this report is considered accurate at the date of issue with regard to the current conditions of the site. The conclusions drawn in the report are based on interpolation between boreholes or test pits. Conditions can vary between test locations that cannot be explicitly defined or inferred by investigation.

Yours faithfully

RCA AUSTRALIA



Jason Haines
Geotechnical Engineer



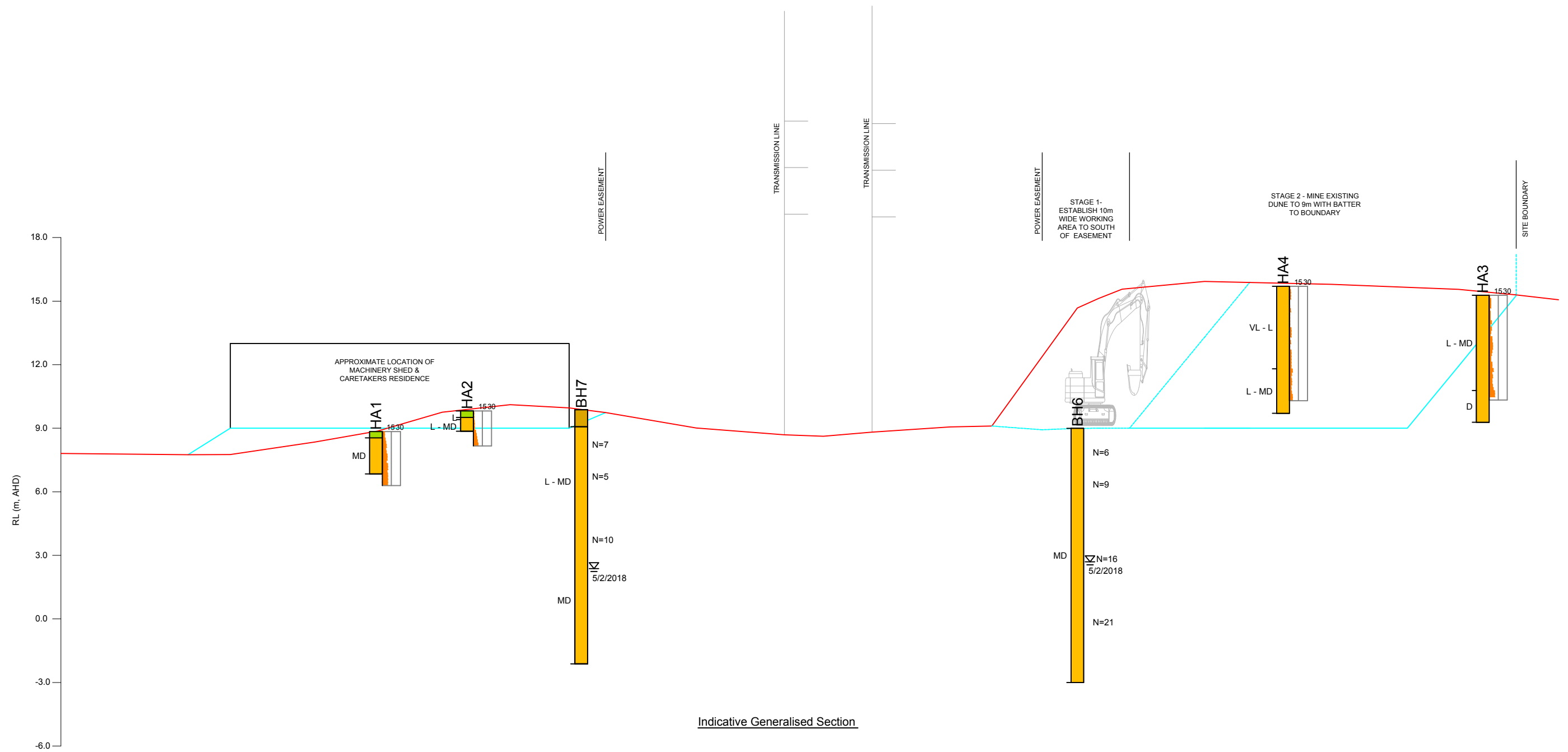
Robert Carr
Principal Geotechnical Engineer

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- [1] Colquhoun G.P., Phillips, G., Hughes, K.S, Deyssing L., Fitzherbert, J.A., & Troedson, A.L. 2015. New South Wales Zone 56 Seamless Geology, version 1 [Digital Dataset], Geological Survey of New South Wales, Maitland.
- [2] Roy P.S. & Boyd R. 1996 Quarterly Geology of South East Australia: a Tectonically Stable, Wave-Dominated, Sediment-Deficient Margin, Field Guide to the Central New South Wales Coast, November 1996, International Geological Correlation Project #367.
- [3] Report titled *RAAF Williamtown Groundwater Modelling for AECOM Services Pty Ltd* by Heritage Computing Pty Ltd TAS Hydro Simulations, Project No:AEC002, Ref HC2016/09d dated June 2016.
- [4] Report titled *Determination of Maximum Predicted Groundwater Level and Maximum Extraction Level at Lot 218 and 220, Salt Ash*, prepared for Mackas Sand Pty Ltd by Umwelt Environmental Consultants November 2011.
- [5] Fityus S., *Calibration of the Blunt Tipped Dynamic Penetrometer for Silica Sands*, Proc of the first International Conference on Site Characterisation, ISC'98/Atlanta/ Georgia USA, 19-22April 1998.

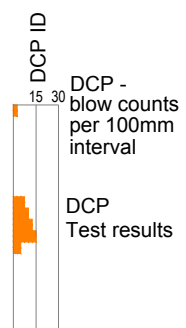
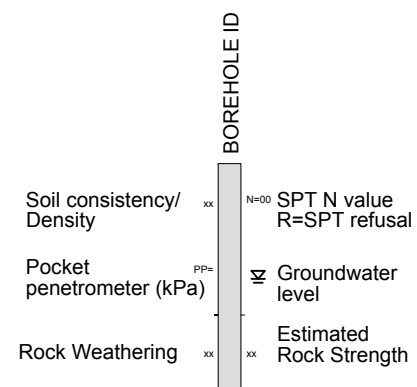
Appendix A

Drawings



LEGEND

-  TOPSOIL
 TOPSOIL/AEOLIAN
 AEOLIAN



NOTE: Reproduced from drawing supplied by
Tattersall Lander
Ref No. 21800004, Sheet 4

Test holes not surveyed. Bores positioned
in levels to match ground surface on section.
Test holes projected onto section

SCALE

Horizontal = 1 : 500 (A3)
Vertical = 1 : 200 (A3)



INDICATIVE GENERALISED SECTION
4226 NELSON BAY ROAD
ANNA BAY

CLIENT Tattersall Lander Pty Ltd		RCA Ref 13280-201/1	
DRAWN BY JH	SCALE As Shown (A3)	DRAWING No 2	REV 0
APPROVED BY RJC	DATE 21/08/2018	OFFICE NEWCASTLE	

Appendix B

Borehole and Hand Auger Borehole Logs

Piezometer Diagrams

Explanatory Notes

PROJECT No: 13280

DATE: 30/01/2018

CLIENT: Tattersall Lander Pty Ltd

SURFACE RL:

PROJECT: Geotechnical Investigation

COORDS:

LOCATION: 4226 Nelson Bay Road, Anna Bay

EXCAVATION METHOD: Hand Auger with Sand Attachment

Borehole Information					Field Material Information					
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Not Encountered	4		0.20m	0.30		SM	TOPSOIL, Silty SAND, fine to medium grained, grey	D		TOPSOIL PSP method used for Dynamic Penetrometer
	4		0.30m							
	5		0.70m	0.5		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m
	6									
	7									
	6									
	7		0.80m	1.0		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m
	8									
	8									
	7									
	9		1.30m	1.5		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m
	9									
	8									
	9									
	9		1.40m	2.00		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m
	9									
8										
9										
9	1.80m	2.00		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m		
9										
8										
9										
9	D	2.00		SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m		
9										
8										
9										
9	2.00m					SP	SAND, fine to medium grained, grey, poorly graded, trace of silt Becoming mottled pale yellow-white and grey at 0.6m Becoming red-brown mottled grey at 1.0m	M	MD	AEOLIAN Small root at 0.6m Small root at 0.9m
9										
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LOGGED: JH						CHECKED: RJC		DATE: 05/03/2018		

DATE: 30/01/2018
SURFACE RL:
COORDS:
EXCAVATION METHOD: Hand Auger with Sand Attachment

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE: 30/01/2018
 SURFACE RL:
 COORDS:
 EXCAVATION METHOD: Hand Auger with Sand Attachment

Borehole Information					Field Material Information					
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Not Encountered	1			0.5 </						

PROJECT No: 13280
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Borehole Information					Field Material Information					
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Not Encountered			D 5.10m			SP	SAND, fine to medium grained, pale yellow-white, poorly graded	M	D	AEOLIAN
			5.30m							
			D 5.40m							
				5.5						
			5.90m							
			D 6.00m	6.00			HAND AUGER HA3 TERMINATED AT 6.00 m			
				6.5						
				7.0						
				7.5						
				8.0						
				8.5						
				9.0						
				9.5						
LOGGED: JH						CHECKED: RJC			DATE: 05/03/2018	

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Borehole Information					Field Material Information																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Not Encountered	1			0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.00m		SP	SAND, fine to medium grained, pale yellow-white, poorly graded	D	VL - L	AEOLIAN PSP method used for Dynamic Penetrometer																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
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PROJECT No: 13280
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 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE: 30/01/2018
 SURFACE RL:
 COORDS:
 EXCAVATION METHOD: Hand Auger with Sand Attachment

Borehole Information						Field Material Information				
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Not Encountered	4		D 5.10m	5.5		SP	SAND, fine to medium grained, pale yellow-white, poorly graded	M	L - MD	AEOLIAN
	5									
	5									
	5.50m D 5.60m									
	5.90m D 6.00m									
				6.00			HAND AUGER HA4 TERMINATED AT 6.00 m			
				6.5						
				7.0						
				7.5						
				8.0						
				8.5						
				9.0						
				9.5						
LOGGED: JH						CHECKED: RJC			DATE: 05/03/2018	

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE: 30/01/2018
 SURFACE RL:
 COORDS:
 EXCAVATION METHOD: Hand Auger with Sand Attachment

Borehole Information					Field Material Information					
WATER	DYNAMIC PENETROMETER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Not Encountered	3					SM	TOPSOIL, Silty SAND, fine to medium grained, grey-black, poorly graded	D		TOPSOIL PSP method used for Dynamic Penetrometer
	2		0.20m							
			0.30m	0.30						
	1					SP	SAND, fine to medium grained, grey, trace of silt, poorly graded		L	AEOLIAN
	1									Water added at 0.5m
			0.70m				Becoming pale grey at 0.7m			
	4		0.80m				Becoming brown at 0.9m	M	D	
	5			1.0						Lots of roots from 0.9m to 1.2m
	6		1.20m							
	6			1.30m						
	6			1.50						
	6						HAND AUGER HA5 TERMINATED AT 1.50 m			
	5									
	5									
	5			2.0						
	7									
	8									
	8			2.5						
				3.0						
		3.5								
		4.0								
		4.5								
LOGGED: JH						CHECKED: RJC		DATE: 05/03/2018		

GEOTECHNICAL BOREHOLE LOG

BH6

SHEET 1 OF 3

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
 DATE COMPLETED: 23/01/2018
 SURFACE RL:
 COORDS:
 DRILL MODEL: Track Mounted Hanjin 8D

Borehole Information					Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger			0.10m			SP	SAND, fine to medium grained, pale yellow-white, poorly graded	D	MD	AEOLIAN
			0.20m				M			
			0.40m							
			0.50m	0.5			Becoming grey-black, with a trace of silt at 0.4m			
		1.00m	1.00m	1.0			Becoming pale grey, without a trace of silt at 1.0m			
		SPT 3, 3, 3 N=6	D							
		1.45m	1.45m	1.5			Becoming mottled pale yellow-white, red and brown at 1.4m			

GEOTECHNICAL BOREHOLE LOG

BH6

SHEET 2 OF 3

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
 DATE COMPLETED: 23/01/2018
 SURFACE RL:
 COORDS:
 DRILL MODEL: Track Mounted Hanjin 8D

Borehole Information					Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger	23/01/18 05/02/18					SP	SAND, fine to medium grained, pale yellow-white, poorly graded	M	MD	AEOLIAN
				5.5						
		6.00m	6.00m	6.0						
		SPT 4, 8, 8 N=16	D							
		6.45m	6.45m	6.5						
				7.0						
				7.5						
				8.0						
				8.5						
		9.00m	9.00m	9.0						
		SPT 7, 10, 11 N=21	D							
		9.45m	9.45m	9.5						
		LOGGED: JH						CHECKED: RJC		

GEOTECHNICAL BOREHOLE LOG

BH6

SHEET 3 OF 3

PROJECT No: 13280
CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
DATE COMPLETED: 23/01/2018
SURFACE RL:
COORDS:
DRILL MODEL: Track Mounted Hanjin 8D

Borehole Information						Field Material Information				
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger				10.5		SP	SAND, fine to medium grained, pale yellow-white, poorly graded	W	MD	AEOLIAN
				11.0						
				11.5						
				12.00			BOREHOLE BH6 TERMINATED AT 12.00 m			
				12.5						
				13.0						
				13.5						
				14.0						
				14.5						
LOGGED: JH						CHECKED: RJC			DATE: 05/03/2018	

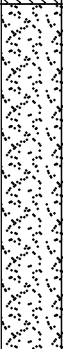
GEOTECHNICAL BOREHOLE LOG

BH7

SHEET 1 OF 3

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
 DATE COMPLETED: 23/01/2018
 SURFACE RL:
 COORDS:
 DRILL MODEL: Track mounted Hanjin 8D

Borehole Information					Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger						SP-SM	TOPSOIL, SAND, fine to medium grained, grey, with silt	D		TOPSOIL / AEOLIAN
				0.5						
				0.80		SP	SAND, fine to medium grained, red-brown, poorly graded		L - MD	AEOLIAN
				1.0						
			1.50m	1.50m						
			SPT 4, 3, 4 N=7	D						
			1.95m	1.95m						
									M	
			3.00m	3.00m						
			SPT 3, 2, 3 N=5	D						
			3.45m	3.45m						
	LOGGED: JH						CHECKED: RJC			DATE: 05/03/2018

GEOTECHNICAL BOREHOLE LOG

BH7

SHEET 2 OF 3

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
 DATE COMPLETED: 23/01/2018
 SURFACE RL:
 COORDS:
 DRILL MODEL: Track mounted Hanjin 8D

Borehole Information					Field Material Information					
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger	23/01/18					SP	SAND, fine to medium grained, red-brown, poorly graded	M	L - MD	AEOLIAN
				5.5						
		6.00m	6.00m	6.0						
		SPT 3, 4, 6 N=10	D						MD	
		6.45m	6.45m	6.5						
				7.0						
				7.5				W		
				8.0						
				8.5						
				8.80m						
				8.90m						
				9.0						
				9.5						
LOGGED: JH						CHECKED: RJC		DATE: 05/03/2018		

GEOTECHNICAL BOREHOLE LOG

BH7

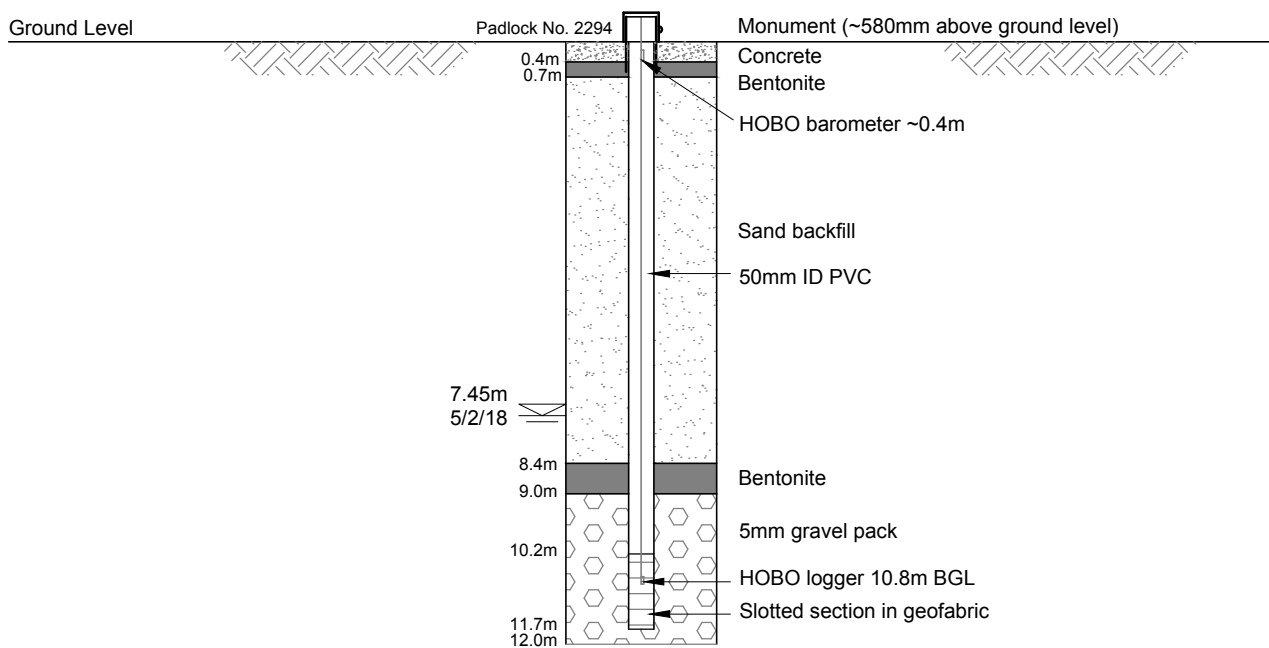
SHEET 3 OF 3

PROJECT No: 13280
 CLIENT: Tattersall Lander Pty Ltd
 PROJECT: Geotechnical Investigation
 LOCATION: 4226 Nelson Bay Road, Anna Bay

DATE COMMENCED: 23/01/2018
 DATE COMPLETED: 23/01/2018
 SURFACE RL:
 COORDS:
 DRILL MODEL: Track mounted Hanjin 8D

Borehole Information						Field Material Information				
METHOD	WATER	FIELD TEST	SAMPLE	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	DESCRIPTION (SOIL NAME; plasticity/grain size, colour, particle shape, secondary components, minor constituents) (ROCK NAME; grain size, colour, minor constituents)	MOISTURE/ WEATHERING	CONSISTENCY/ RELATIVE DENSITY/ STRENGTH	STRUCTURE AND ADDITIONAL OBSERVATIONS
Hollow Flight Auger				10.5		SP	SAND, fine to medium grained, red-brown, poorly graded	W	MD	AEOLIAN
				11.0						
				11.5						
				12.000			BOREHOLE BH7 TERMINATED AT 12.00 m			
				12.5						
				13.0						
				13.5						
				14.0						
				14.5						
LOGGED: JH						CHECKED: RJC			DATE: 05/03/2018	

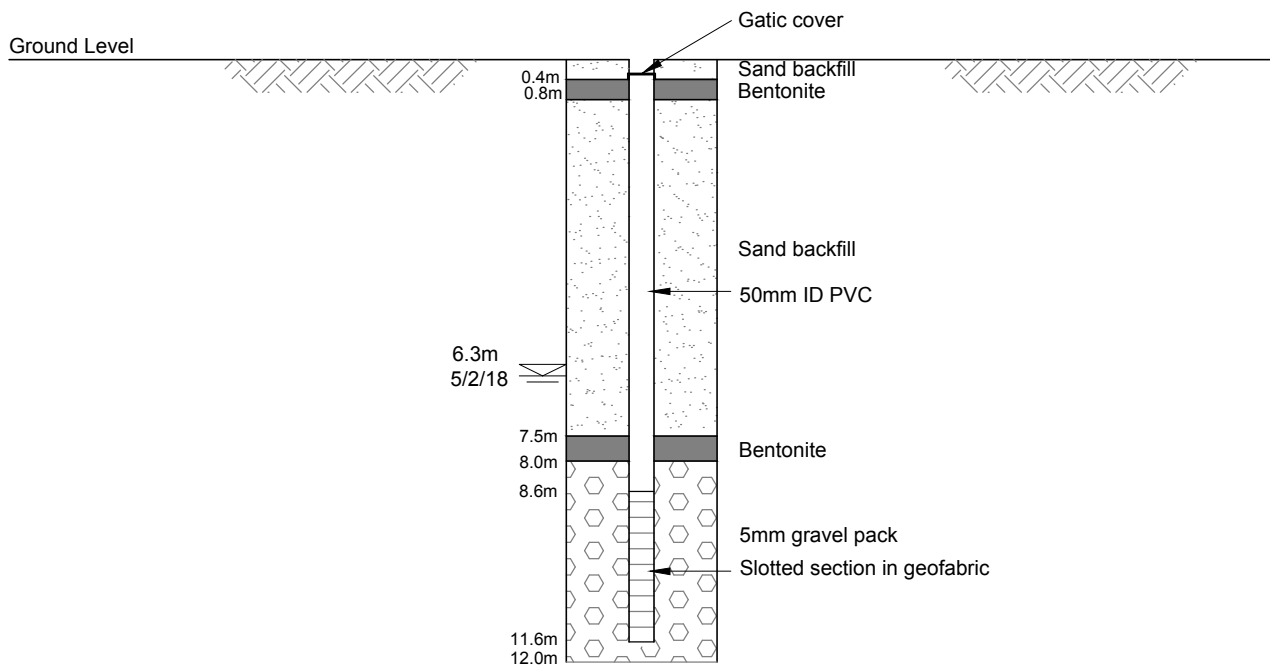
PZ1



STANDPIPE PIEZOMETER
CONSTRUCTION DETAILS
4226 NELSON BAY ROAD
ANNA BAY

CLIENT	Tattersall Lander Pty Ltd			
DRAWN BY	JH	SCALE	N.T.S.	RCA Ref 13280-201/2
APPROVED BY	RJC	DATE	21/08/2018	DRAWING No PZ1 Rev 0
				OFFICE NEWCASTLE

PZ2



STANDPIPE PIEZOMETER
CONSTRUCTION DETAILS
4226 NELSON BAY ROAD
ANNA BAY

CLIENT		Tattersall Lander Pty Ltd			
DRAWN BY	JH	SCALE	N.T.S.	RCA Ref	13280-201/2
APPROVED BY	RJC	DATE	21/08/2018	DRAWING No	PZ2
				Rev	0
				OFFICE NEWCASTLE	

CDT-DWG-A4V-001/1

Explanatory Notes – Soil Description

In engineering terms soil includes every type of uncemented or partially cemented material found in the ground. In practice if the material can be remoulded by hand in its field condition or in water it is described as a soil. The dominant soil constituent is given in capital letters and the secondary features in lower case. The dominant feature is assessed from AS 1726:2017 – *Geotechnical Site Investigations* and a soil symbol is used to define a soil layer.

METHOD

Method	Description
AD/T	Auger Drilling with tungsten carbide bit
AD/V	Auger Drilling with V Bit
AS	Auger Screwing
AT	Air Track
BH	Backhoe
CT	Cable Tool Rig
DB	Washbore Drag Bit
DT	Diatube
E	Excavator
EH	Excavator with Hammer
HA	Hand Auger
H	Diamond Core-63mm diameter
N	Natural Exposure
NMLC	Diamond Core-52mm diameter
N	Diamond Core-47mm diameter
Percussion	Percussion Drilling
PT	Push Tube
RR	Rock Roller
V	Vacuum Excavation
WS	Washbore
	Existing Excavation

WATER

 Water level at date shown

 Seepage

NOT ENCOUNTERED: The borehole/test pit was dry soon after excavation. Inflow may have been observed and the borehole/test pit been left open for a longer period.

NOT OBSERVED: The observation of groundwater could not be present or not possible due to drilling water surface seepage or cave in of the borehole/test pit.

SAMPLING

Sample	Description
B	Bulk Disturbed Sample
D	Disturbed Sample
SPT	Standard Penetration Test
U50	Undisturbed Sample - 50mm diameter
U75	Undisturbed Sample - 75mm diameter
ES	Soil Sample - Environmental
EW	Water Sample - Environmental
G	Gas Sample

SOIL CLASSIFICATION

The appropriate symbols are selected based on the result of visual examination, field tests and available laboratory test results such as particle size analysis, liquid limit and plasticity index.

Group Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
CI	Clay of medium plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peat or highly organic soil

MOISTURE CONDITION

For coarse grained soils the following terms are used

Dry - Non-cohesive and free-running
 Moist - Soil feels cool/darkened in colour
 - Soil tends to stick together
 Wet - Soil feels cool/darkened in colour
 - Soil tends to stick together/free water forms when handling

For fine grained soils the following moisture content (%) terms are used

PL - Moist/dry of plastic limit
 $w \approx PL$ - Moist/near plastic limit.
 PL - Moist/et of plastic limit.
 $w \approx LL$ - Wet/near liquid limit.
 LL - Wet/et of liquid limit

PLASTICITY

Soil plasticity is a measure of the range of water content over which a soil exhibits plastic properties. The classification of the degree of plasticity in terms of the Liquid Limit (LL) is as follows.

Description of Plasticity	Range of Liquid Limit for Silt	Range of Liquid Limit for Clay
Non-plastic	Not applicable	Not applicable
Low plasticity	≤ 50	≤ 35
Medium plasticity	Not applicable	35 and ≤ 50
High plasticity	≥ 50	≥ 50

COHESIVE SOILS – CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by and penetrometer, dynamic cone penetrometer or vane shear values and by resistance to deformation to hand moulding.

A hand penetrometer may be used in the field or the laboratory to provide an approximate assessment of the unconfined compressive strength (UCS) of cohesive soils. Undrained shear strength $c_u \approx 0.5 \text{ UCS}$. Undrained shear strength values are recorded in kPa as follows.

Strength	Symbol	Indicative Undrained Shear Strength, c_u (kPa)
Very Soft	VS	≤ 12
Soft	S	12 and ≤ 25
Firm	F	25 and ≤ 50
Stiff	St	50 and ≤ 100
Very Stiff	VSt	100 and ≤ 200
Hard	H	≥ 200
Variable	Vr	

COHESIONLESS SOILS – RELATIVE DENSITY

Relative density terms such as very loose, loose, medium dense, dense and very dense are used to describe silty and sandy material and these are usually based on resistance to drilling penetration, Standard Penetration Test (SPT) N values or Per cent Sand Penetrometer resistance.

Term	Symbol	Density Index
Very Loose	VL	0 to 15
Loose	L	15 to 35
Medium Dense	MD	35 to 65
Dense	D	65 to 85
Very Dense	VD	≥ 85

SOIL PARTICLE SIZE DESCRIPTIVE TERMS

Fraction	Name	Subdivision	Size (mm)
Oversize	Boulders		≥ 200
	Cobbles		63 to 200
Coarse grained soil	Gravel	Coarse	19 to 63
		Medium	6.7 to 19
	Sand	Fine	2.36 to 6.7
		Coarse	0.6 to 2.36
Fine grained soil	Silt	Medium	0.21 to 0.6
		Fine	0.075 to 0.21
	Clay		0.002 to 0.075
			≥ 0.002

Explanatory Notes - Rock Description

METHOD

Refer to soil description sheet.

WATER

Refer to soil description sheet.

ROCK QUALITY

The defect spacing is shown where applicable and the Rock Quality Designation (RQD) and Total Core Recovery (TCR) for each core run is given where:

$$TCR = \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\%$$

$$RQD = \frac{\text{Sum of axial length of sound core pieces } \geq 100\text{mm long}}{\text{Length of core run}} \times 100\%$$

ROCK MATERIAL WEATHERING

Rock material weathering is described using the abbreviations and definitions used in AS1726:2017 – *Geotechnical Site Investigations*.

Term	Abbreviation		Definition
Residual Soil	RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible but the soil has not been significantly transported.
Extremely weathered	EW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered	HW	The whole of the rock material is discoloured usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
		DW	
Moderately Weathered		MW	The whole of the rock material is discoloured usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.
Slightly Weathered	SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR		Rock shows no sign of decomposition of individual minerals or colour changes.

Where it is not practicable to distinguish between Highly Weathered and Moderately Weathered rock the term Distinctly Weathered may be used. Distinctly Weathered is defined as follows: Rock strength usually changed by weathering. The rock may be slightly discoloured usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in the pores. There is some change in rock strength.

ROCK MATERIAL STRENGTH

Rock strength is described using AS1726:2017 – *Geotechnical Site Investigations* and ISRM – *Commission on Standardisation of Laboratory and Field Tests*, 'Suggested method of determining the Uniaxial Compressive Strength of Rock materials and the Point Load Index' as follows:

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Point Load Index Is_{50} (MPa)
Very Low	VL	0.6 to 2	0.03 to 0.1
Low	L	2 to 6	0.1 to 0.3
Medium	M	6 to 20	0.3 to 1
High	H	20 to 60	1 to 3
Very High	VH	60 to 200	3 to 10
Extremely High	EH	≥ 200	≥ 10

◀ Diametral Point Load Index test.

▼ Axial Point Load Index test.

DEFECT SPACING/BEDDING THICKNESS

Depending on the project may be either described as mean perpendicular spacing within a set of defects or bedding or as the spacing between all defects within the rock mass.

Term	Defect Spacing	Bedding
Extremely closely spaced	≤ 6 mm 6 to 20 mm	Thinly laminated Laminated
Very closely spaced	20 to 60 mm	Very thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2.0 m	Thick
Very widely spaced	≥ 2 m	Very thick

DEFECT DESCRIPTION

Type	Definition
JT	Joint
BP	Bedding Parting
CO	Contact
CS	Clay Seam
CZ	Crush Zone
D	Dyke
DZ	Decomposed Zone
FC	Fracture
FZ	Fracture Zone
GL	Goliation
GLT	Gault
VN	Vein
SM	Seam
IS	Infilled Seam
SZ	Shear Zone

Planarity	Roughness
PR Planar	VR Very Rough
CU Curved	R Rough
U Undulating	S Smooth
ST Stepped	POL Polished
IR Irregular	SL Slickensided

Symbol	Coating or Infill
CA	Calcite
Clay	Clay
CN	Clean
Fe	Iron oxide
OT	Oxide
Qu	Quartz
Car	Carbonaceous
SN	Stain
VNR	Veneer

The inclinations of defects are measured from perpendicular to the core axis.

Appendix C

Double Ring Infiltrometer Test Results

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

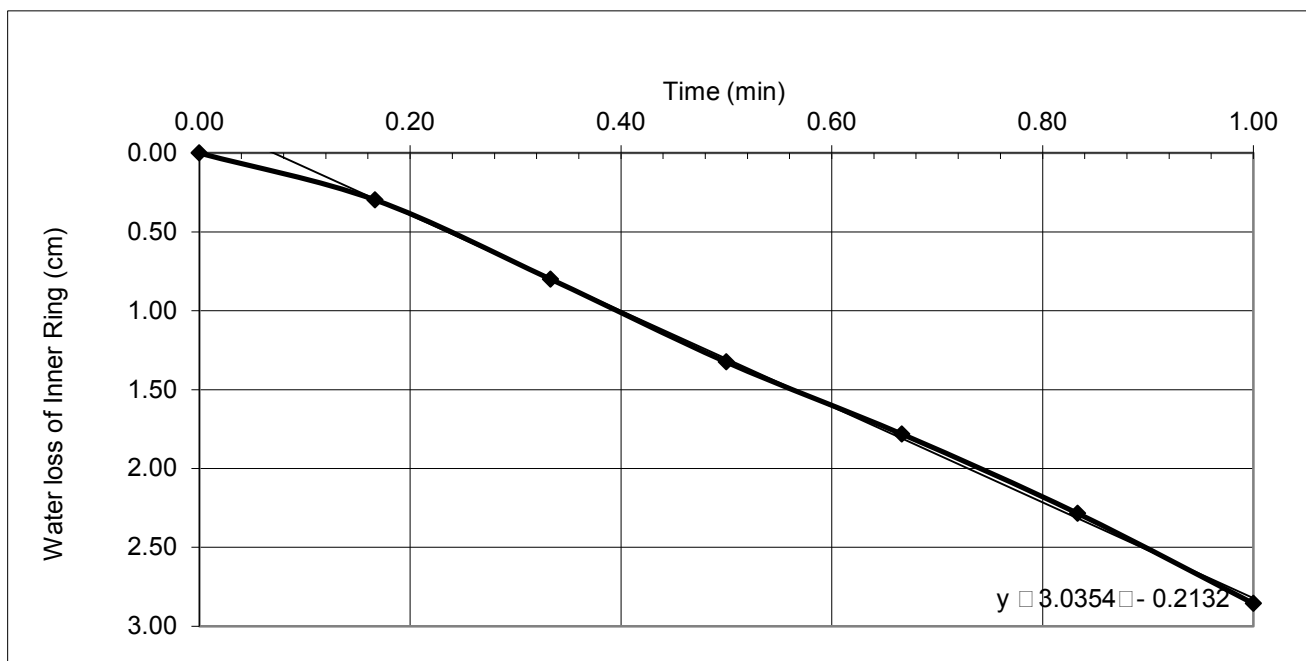
TEST METHOD: Constant Head

BORE DETAILS

Test No IN1a
 Dept 10 cm
 Dept of water in rings 20 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
4:35:00 PM	0.00	143.0	0.00
4:35:10 PM	0.17	130.0	0.30
4:35:20 PM	0.33	108.0	0.80
4:35:30 PM	0.50	85.0	1.33
4:35:40 PM	0.67	65.0	1.78
4:35:50 PM	0.83	43.0	2.28
4:36:00 PM	1.00	18.0	2.86



CALCULATED INFILTRATION RATE 3.04E+00 cm / min
 5.1E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by:	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

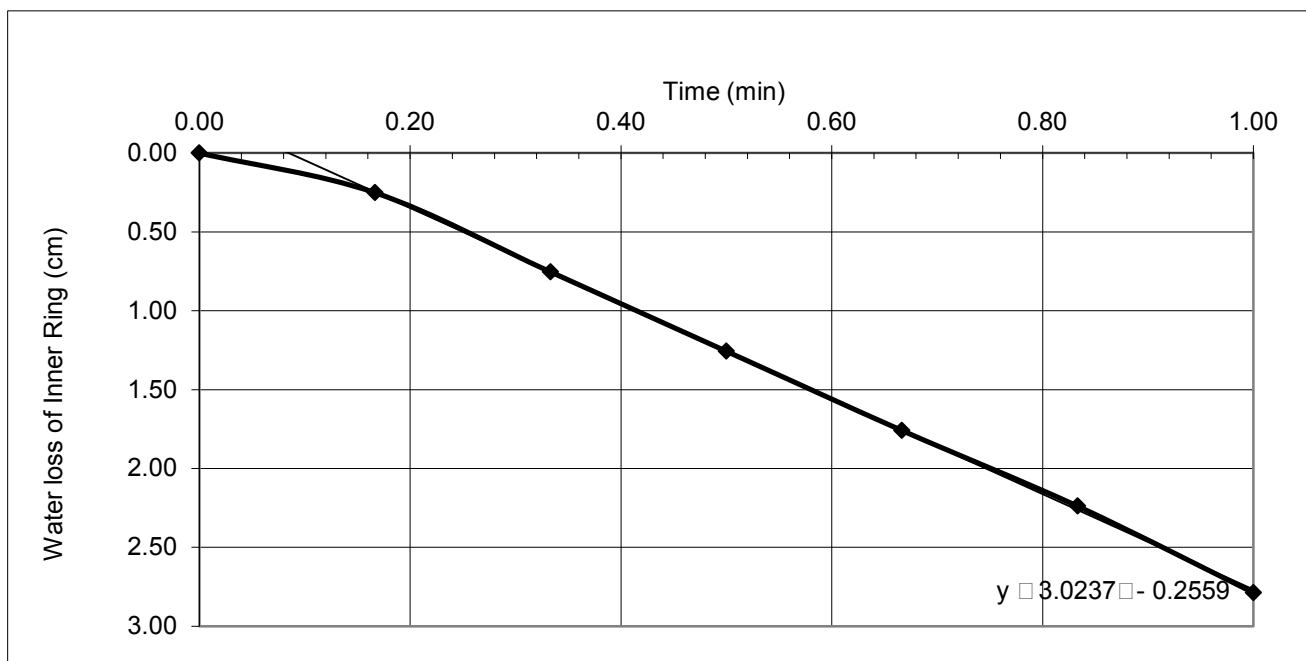
TEST METHOD: Constant Head

BORE DETAILS

Test No IN 1b
 Dept 10 cm
 Dept of water in rings 20 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
4:48:00 PM	0.00	124.0	0.00
4:48:10 PM	0.17	113.0	0.25
4:48:20 PM	0.33	91.0	0.75
4:48:30 PM	0.50	69.0	1.26
4:48:40 PM	0.67	47.0	1.76
4:48:50 PM	0.83	26.0	2.24
4:49:00 PM	1.00	2.0	2.79



CALCULATED INFILTRATION RATE 3.02E+00 cm / min
 5.0E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

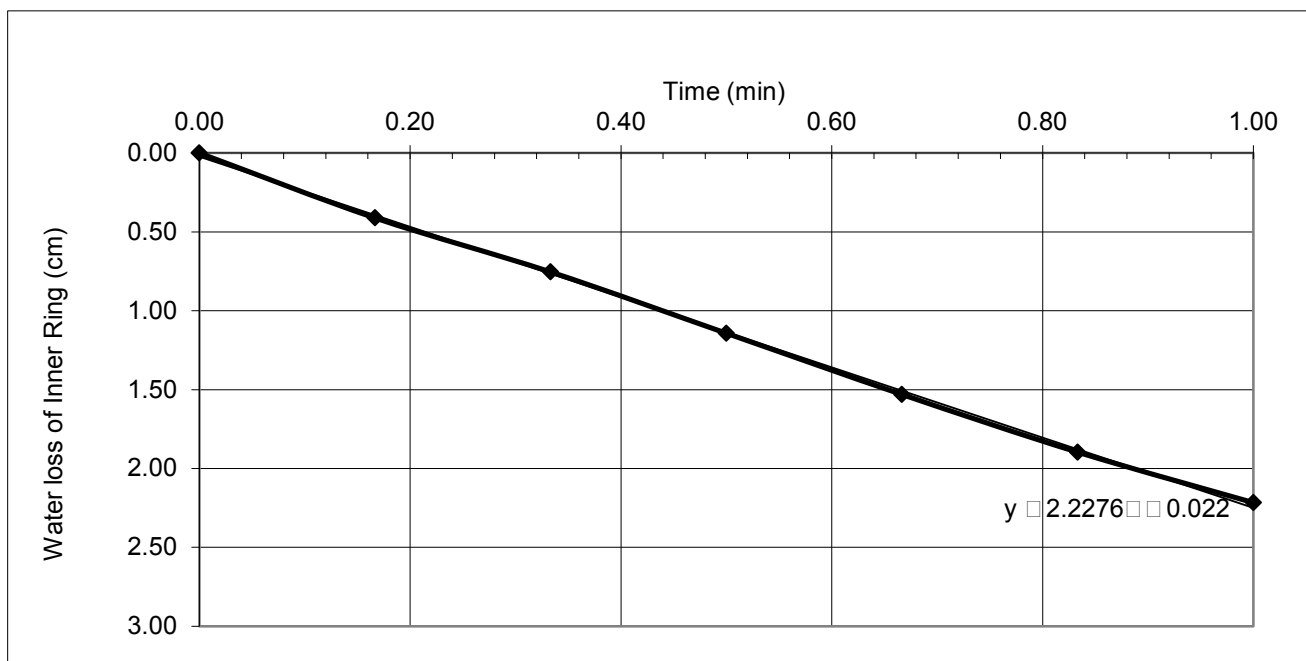
TEST METHOD: Constant Head

BORE DETAILS

Test No IN02a
 Dept 10 cm
 Dept of water in rings 25 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
5/27/00 PM	0.00	124.0	0.00
5/27/10 PM	0.17	106.0	0.41
5/27/20 PM	0.33	91.0	0.75
5/27/30 PM	0.50	74.0	1.14
5/27/40 PM	0.67	57.0	1.53
5/27/50 PM	0.83	41.0	1.90
5/28/00 PM	1.00	27.0	2.22



CALCULATED INFILTRATION RATE 2.22E+00 cm / min
 3.7E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

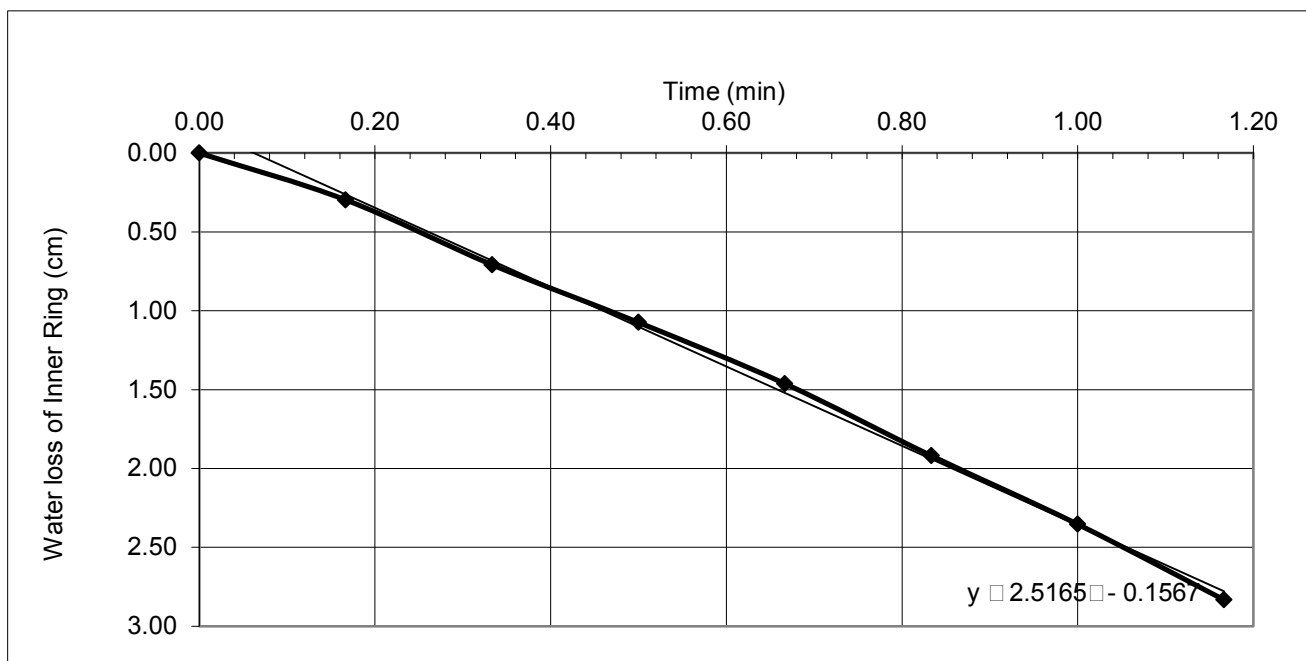
TEST METHOD: Constant Head

BORE DETAILS

Test No IN 2b
 Dept 10 cm
 Dept of water in rings 25 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
5:35:00 PM	0.00	133.0	0.00
5:35:10 PM	0.17	120.0	0.30
5:35:20 PM	0.33	102.0	0.71
5:35:30 PM	0.50	86.0	1.07
5:35:40 PM	0.67	69.0	1.46
5:35:50 PM	0.83	49.0	1.92
5:36:00 PM	1.00	30.0	2.35
5:36:10 PM	1.17	9.0	2.83



CALCULATED INFILTRATION RATE 2.51E+00 cm / min
 4.2E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

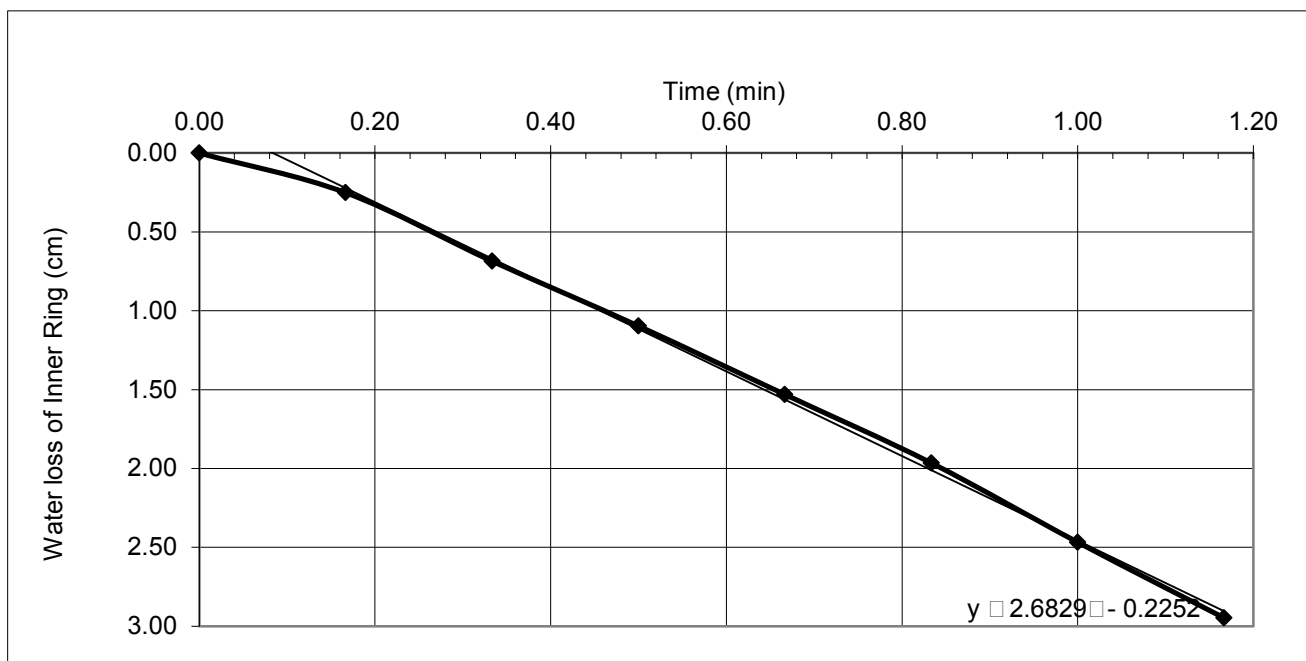
TEST METHOD: Constant Head

BORE DETAILS

Test No IN3a
 Dept 10 cm
 Dept of water in rings 20 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
5:58:00 PM	0.00	138.0	0.00
5:58:10 PM	0.17	127.0	0.25
5:58:20 PM	0.33	108.0	0.69
5:58:30 PM	0.50	90.0	1.10
5:58:40 PM	0.67	71.0	1.53
5:58:50 PM	0.83	52.0	1.96
5:59:00 PM	1.00	30.0	2.47
5:59:10 PM	1.17	9.0	2.95



CALCULATED INFILTRATION RATE 2.68E+00 cm / min
 4.5E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 5/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

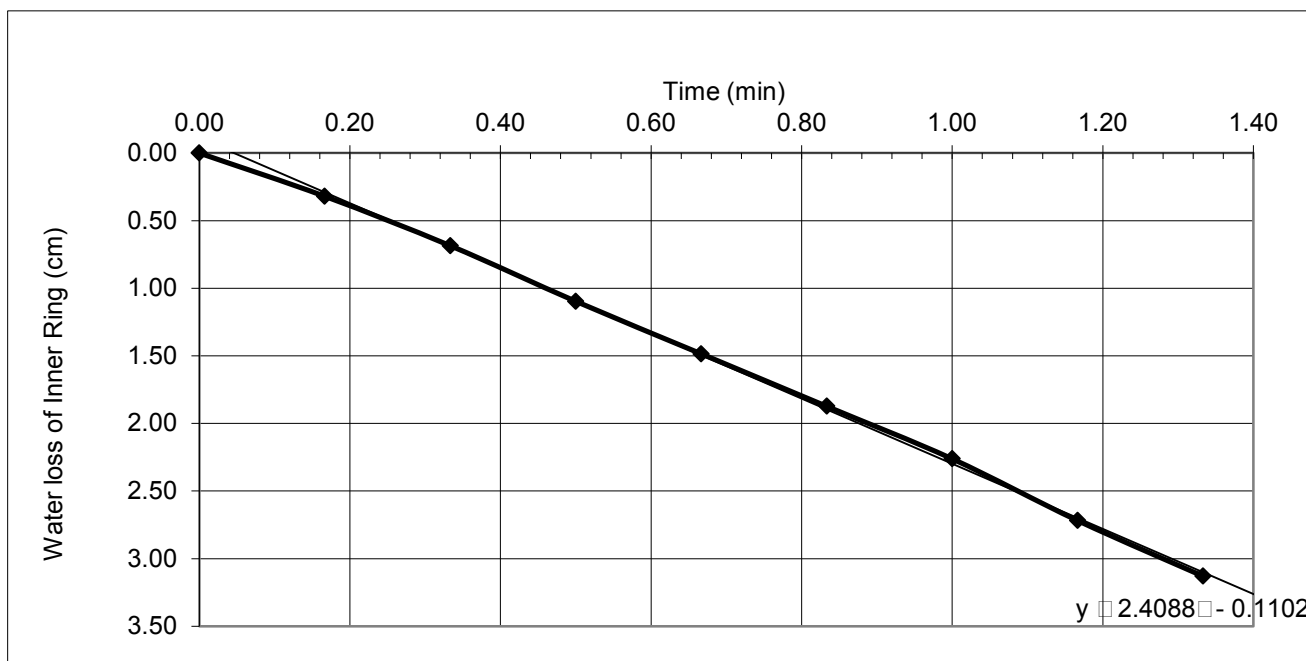
TEST METHOD: Constant Head

BORE DETAILS

Test No IN 3b
 Dept 10 cm
 Dept of water in rings 20 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
6:05:00 PM	0.00	137.0	0.00
6:05:10 PM	0.17	123.0	0.32
6:05:20 PM	0.33	107.0	0.69
6:05:30 PM	0.50	89.0	1.10
6:05:40 PM	0.67	72.0	1.49
6:05:50 PM	0.83	55.0	1.87
6:06:00 PM	1.00	38.0	2.26
6:06:10 PM	1.17	18.0	2.72
6:06:20 PM	1.33	0.0	3.13



CALCULATED INFILTRATION RATE 2.41E+00 cm / min
 4.0E-04 m / sec

RCA Australia	Tested by: JH	Date: 6/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 12/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

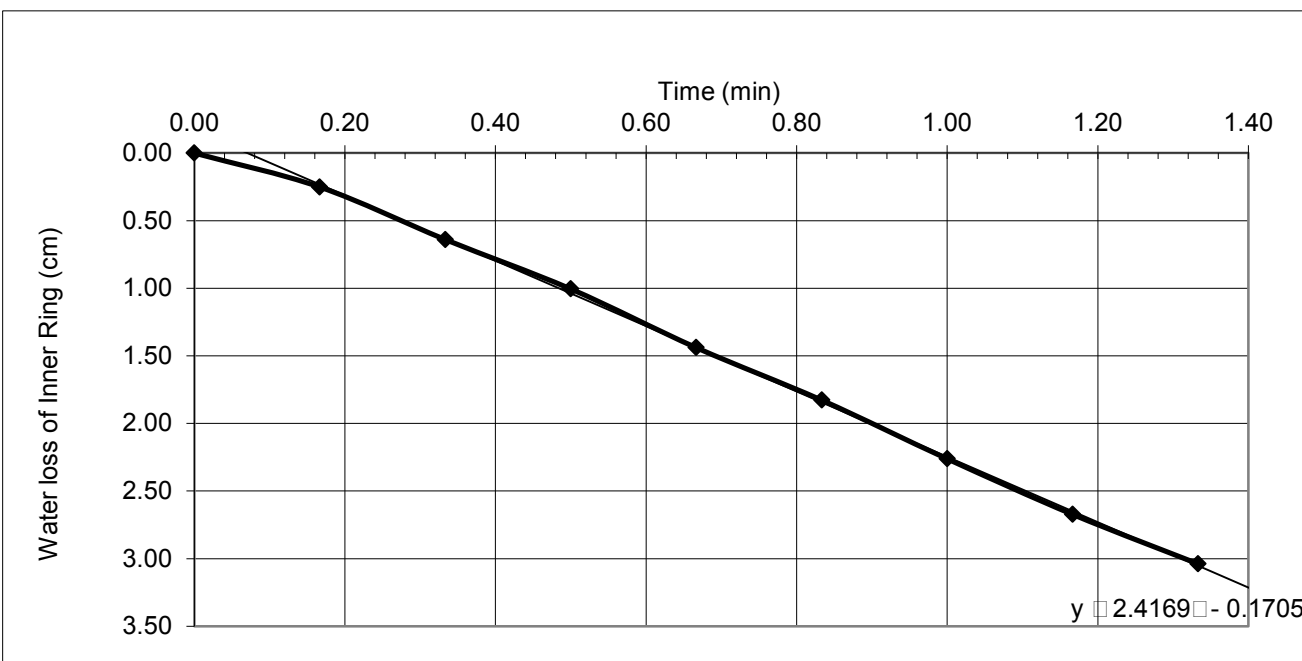
TEST METHOD: Constant Head

BORE DETAILS

Test No IN-4a
 Dept 10 cm
 Dept of water in rings 30 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
5:35:00 PM	0.00	143.0	0.00
5:35:10 PM	0.17	132.0	0.25
5:35:20 PM	0.33	115.0	0.64
5:35:30 PM	0.50	99.0	1.01
5:35:40 PM	0.67	80.0	1.44
5:35:50 PM	0.83	63.0	1.83
5:36:00 PM	1.00	44.0	2.26
5:36:10 PM	1.17	26.0	2.67
5:36:20 PM	1.33	10.0	3.04



CALCULATED INFILTRATION RATE 2.42E+00 cm / min
 4.0E-04 m / sec

RCA Australia	Tested by: JH	Date: 12/2/18
	Checked by: RJC	Date:

DOUBLE RING INFILTROMETER TEST

CLIENT: Tattersall Lander Pty Ltd
PROJECT: Geotechnical Investigation
LOCATION: 4226 Nelson Bay Road Anna Bay

DATE: 12/02/2018
RCA REF: 13280

SOIL DESCRIPTION: SAND

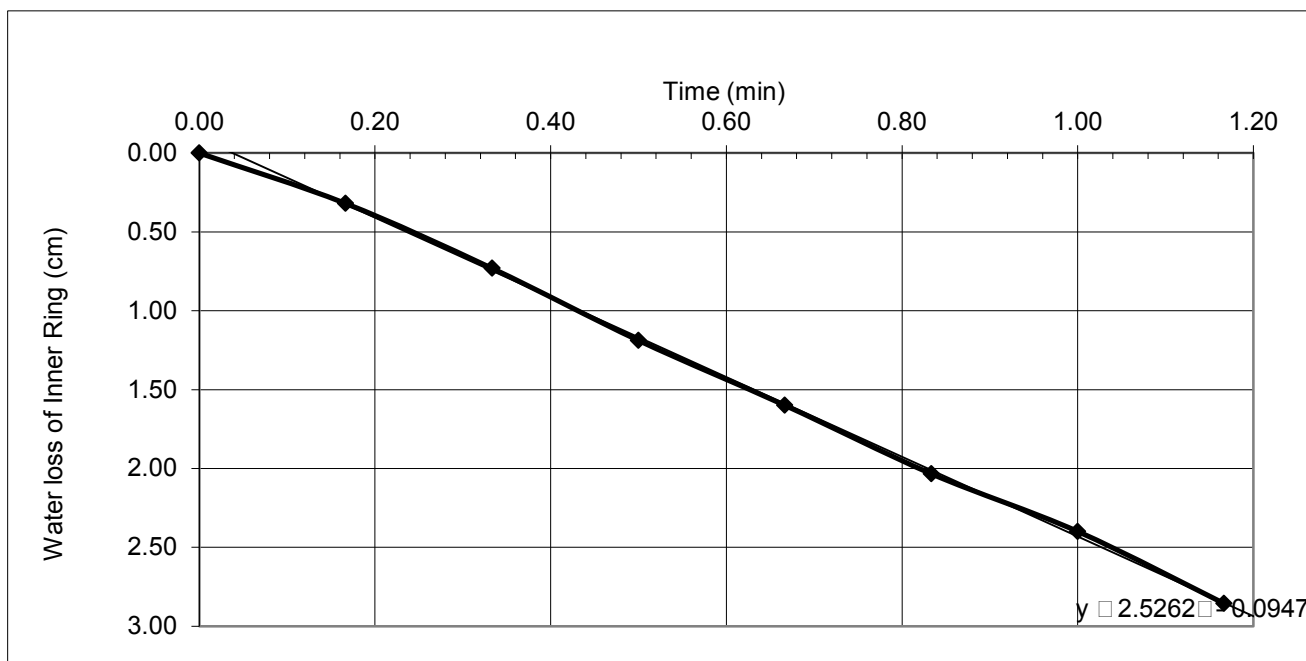
TEST METHOD: Constant Head

BORE DETAILS

Test No IN 4b
 Dept 10 cm
 Dept of water in rings 35 cm
 Internal diameter of inner ring 24 cm
 Internal diameter of outer ring 38.5 cm
 Area of inner ring 452 cm²
 Area of annular space between rings 712 cm²
 Internal diameter of Mariotte tube 3.75 cm
 External diameter of air inlet tube 0.95 cm
 Area of water in Mariotte tube 10.3 cm²

Soil Moisture at Time of Test: Wet

RESULTS			
Time	Elapsed time (min)	Water level in Mariotte tube (cm)	Water loss from inner ring (cm)
5:45:00 PM	0.00	140.0	0.00
5:45:10 PM	0.17	126.0	0.32
5:45:20 PM	0.33	108.0	0.73
5:45:30 PM	0.50	88.0	1.19
5:45:40 PM	0.67	70.0	1.60
5:45:50 PM	0.83	51.0	2.03
5:46:00 PM	1.00	35.0	2.40
5:46:10 PM	1.17	15.0	2.86



CALCULATED INFILTRATION RATE 2.53E+00 cm / min
 4.2E-04 m / sec

RCA Australia	Tested by: JH	Date: 13/2/18
	Checked by: RJC	Date:

Appendix D

Laboratory Test Results

CERTIFICATE OF ANALYSIS

Work Order : **ES1806843**
Client : **ROBERT CARR & ASSOCIATES P/L**
Contact : MS LAURA SCHOFIELD
Address : PO BOX 175 92 HILL ST
 CARRINGTON NSW 2294
Telephone : +61 02 49029200
Project : 13280
Order number : ----
C-O-C number : ----
Sampler : ----
Site : ANNA BAY
Quote number : SYBQ/400/17
No. of samples received : 4
No. of samples analysed : 4

Page : 1 of 2
Laboratory : Environmental Division Sydney
Contact : Customer Services ES
Address : 277-289 Woodpark Road Smithfield NSW Australia 2164

Telephone : +61-2-8784 8555
Date Samples Received : 06-Mar-2018 15:17
Date Analysis Commenced : 12-Mar-2018
Issue Date : 12-Mar-2018 19:08



Accreditation No. 825
 Accredited for compliance with
 ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 ^ = This result is computed from individual analyte detections at or above the level of reporting
 ø = ALS is not NATA accredited for these tests.
 ~ = Indicates an estimated value.

Analytical Results

Sub-Matrix: SOIL
 (Matrix: SOIL)

Client sample ID

				BH6 4.0-4.1	BH3 5.9-6.0	BH4 4.0-4.1	BH4 5.9-6.0	----
Client sampling date / time				23-Jan-2018 00:00	23-Jan-2018 00:00	23-Jan-2018 00:00	23-Jan-2018 00:00	----
Compound	CAS Number	LOR	Unit	ES1806843-001	ES1806843-002	ES1806843-003	ES1806843-004	-----
				Result	Result	Result	Result	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	0.008	0.007	0.005	0.007	----

QUALITY CONTROL REPORT

Work Order	: ES1806843	Page	: 1 of 3
Client	: ROBERT CARR & ASSOCIATES P/L	Laboratory	: Environmental Division Sydney
Contact	: MS LAURA SCHOFIELD	Contact	: Customer Services ES
Address	: PO BOX 175 92 HILL ST CARRINGTON NSW 2294	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 02 49029200	Telephone	: +61-2-8784 8555
Project	: 13280	Date Samples Received	: 06-Mar-2018
Order number	: ----	Date Analysis Commenced	: 12-Mar-2018
C-O-C number	: ----	Issue Date	: 12-Mar-2018
Sampler	: ----		
Site	: ANNA BAY		
Quote number	: SYBQ/400/17		
No. of samples received	: 4		
No. of samples analysed	: 4		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high

Key :
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
 LOR = Limit of reporting
 RPD = Relative Percentage Difference
 # = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA026 : Chromium Reducible Sulfur (QC Lot: 1484917)									
EB1806061-001	Anonymous	EA026: Chromium Reducible Sulphur	----	0.005	%	0.025	0.026	0.00	No Limit



Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

Sub-Matrix: SOIL				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike Concentration	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit			Result	LCS	Low
EA026 : Chromium Reducible Sulfur (QCLot: 1484917)								
EA026: Chromium Reducible Sulphur	----	0.005	%	<0.005	0.25483 %	84.0	70	130

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES1806843	Page	: 1 of 4
Client	: ROBERT CARR & ASSOCIATES P/L	Laboratory	: Environmental Division Sydney
Contact	: MS LAURA SCHOFIELD	Telephone	: +61-2-8784 8555
Project	: 13280	Date Samples Received	: 06-Mar-2018
Site	: ANNA BAY	Issue Date	: 12-Mar-2018
Sampler	: ----	No. of samples received	: 4
Order number	: ----	No. of samples analysed	: 4

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, **NO** surrogate recovery outliers occur.

Outliers : Analysis Holding Time Compliance

- Analysis Holding Time Outliers exist - please see following pages for full details.

Outliers : Frequency of Quality Control Samples

- Quality Control Sample Frequency Outliers exist - please see following pages for full details.



Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA026 : Chromium Reducible Sulfur						
Snap Lock Bag BH6 4.0-4.1, BH4 4.0-4.1,	BH3 5.9-6.0, BH4 5.9-6.0	12-Mar-2018	24-Jan-2018	47	----	----

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type	Count		Rate (%)		Quality Control Specification
Method	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Chromium Reducible Sulphur	1	11	9.09	10.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: ✖ = Holding time breach ; ✔ = Within holding time.

Method	Sample Date	Extraction / Preparation			Analysis			
Container / Client Sample ID(s)		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation	
EA026 : Chromium Reducible Sulfur								
Snap Lock Bag (EA026)								
BH6 4.0-4.1, BH4 4.0-4.1,	BH3 5.9-6.0, BH4 5.9-6.0	23-Jan-2018	12-Mar-2018	24-Jan-2018	✖	12-Mar-2018	10-Jun-2018	✔



Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Chromium Reducible Sulphur	EA026	1	11	9.09	10.00	✖	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Reducible Sulphur	EA026	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Reducible Sulphur	EA026	1	11	9.09	5.00	✔	NEPM 2013 B3 & ALS QC Standard



Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Reducible Sulphur	EA026	SOIL	In house: Referenced to Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H ₂ S by CrCl ₂ solution ; the evolved H ₂ S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house

Appendix B: Acoustic Assessment



advitech

Report

Noise Impact Assessment

Anna Bay Sand Mine

c/o Tattersall Lander Pty Ltd

8 August 2018

Rev 0 (Final)

Report Details

Noise Impact Assessment - Anna Bay Sand Mine

Job #: J0170316, Folder #: F15339, Revision: 0 (Final), Date: 8 August 2018

Filename: 15339 Anna Bay Sand Mine NIA Rev0.docx

Prepared For

c/o Tattersall Lander Pty Ltd

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History

Date	Revision	Comments
13/03/18	C	Draft Issue for Review
8/08/18	0	Final Issue

Endorsements

Function	Signature	Name and Title	Date
Prepared by		Dale Redwood Senior Environmental Scientist (M.A.A.S)	8 August 2018
Checked by		Clayton Sparke Senior Environmental Scientist (M.A.A.S)	8 August 2018
Authorised for Release by		Dr Rod Bennison Lead Environmental Scientist	8 August 2018

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EXECUTIVE SUMMARY

Advitech Environmental was engaged to prepare an assessment of potential noise impacts associated with the construction and operation of a proposed Sand Quarry at Nelson Bay Road, Anna Bay. The construction period is anticipated to take approximately one to two months, with construction activities being undertaken during weekdays from 7:00am to 6:00pm. The development is proposed to operate between the hours of 7:00am and 6:00pm Monday to Friday, and 8:00am to 1:00pm Saturdays. The operation will produce up to 50,000 cubic metres of quarried material per annum.

Noise assessment criteria were established for adjacent sensitive receiving noise environments. Assessment of potential construction and operational phase noise impacts was made using a number of conservative assumptions as outlined in the report. The noise prediction indicates that exceedances of the noise goals may be expected under some construction and operational conditions.

During construction, exceedance of the NMLs at up to five residential receivers and one place of worship may be expected during internal haul road widening works and the works to improve the site access. It is expected that there would not be any exceedance of the *high affected* NMLs during any of the construction activities. Noise impacts would be minimised during the construction phase of the proposal by implementing the universal work practices provided within this report.

During operation, marginal exceedances of the PSNLs at up to three residential receivers and one place of worship may be expected during general quarrying operations and vegetation mulching activities. In addition to universal work practices to minimise the site generated noise, the following noise control recommendations are provided to minimise noise emissions during the operational phase of the proposal:

- during quarrying operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day;
- vegetation mulching is undertaken during periods of higher background noise levels, identified as the periods before 8:00am and after 3:00 pm.
- temporary barriers or local topography may be used to maximise the shielding of the nearby sensitive receivers from vegetation mulching activities.

It is anticipated that the maximum traffic volumes generated by the proposed development would be less than 0.5% of AADT, therefore, it is considered that no significant increase of road traffic noise is expected on Nelson Bay Road as a result of the proposal.

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APPENDICES

APPENDIX I

Background Noise Monitoring

APPENDIX II

Noise Level Contours

1. INTRODUCTION

Hay Enterprises proposes to extract sand within and adjacent to an AusGrid electricity easement, at the southern end of the property at 4226 Nelson Bay Road, Anna Bay. The sand extraction quarry proposes to extract up to a maximum of 50,000 cubic metres of sand per annum, and would assist AusGrid in the maintenance of the electricity easement.

Advitech Pty Limited (t/a Advitech Environmental) has been engaged by Hay Enterprises (c/o Tattersall Lander Pty Ltd) to prepare a Noise Impact Assessment as part of an Environmental Impact Statement (EIS), required under Section 78A(8) of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

It should be noted that this report was prepared by Advitech Pty Limited for Tattersall Lander Pty Ltd ("the customer") in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

1.1 Objectives of the study

The objectives of this study are to undertake a quantitative assessment of the potential on-site construction and operational noise, and off-site transport noise impacts associated with the proposed development.

The Secretary's Environmental Assessment Requirements (SEARs) (EAR 1172), were issued in October 2017, and included the following requirements for the assessment of noise:

- a quantitative assessment of construction and operational noise, and off-site transport noise impacts of the development in accordance with the *Interim Construction Noise Guideline*, *NSW Industrial Noise Policy* and *NSW Road Noise Policy* respectively;
- reasonable and feasible mitigation measures to minimise noise emissions; and
- monitoring and management measures.

The assessment was performed with reference to the following guidelines, policies and standards:

- AS1055.1 *Acoustics - Description and measurement of environmental noise - Part1: General procedures*.
- AS 2436 *Guide to noise and vibration control on construction, demolition and maintenance sites*.
- *Interim Construction Noise Guideline* (ICNG), EPA. 2008.
- *Industrial Noise Policy* (INP). EPA, 2000.
- *INP Application Notes*. EPA 2006.
- *Road Noise Policy* (RNP). EPA, 2011.
- *Noise Policy for Industry* (NPfi). EPA, 2017.

On October 26, 2017, the New South Wales (NSW) *Industrial Noise Policy* (INP, 2000) was replaced by the *Noise Policy for Industry* (NPfi, 2017). The NSW Environment Protection Authority (EPA) has established transitional arrangements to allow industry and regulators to shift to the new assessment

framework. Under the transitional arrangements, where SEARs were issued before the release of the new policy, and have not been modified, the assessment requirements referenced in the SEARs will apply for a period of two (2) years from the date of issue of the SEARs consistent with the provisions of the *Environmental Planning and Assessment Regulation 2000*, Schedule 2, Part 2, 3(7). This assessment is therefore undertaken in accordance with the provisions of the INP.

2. PROJECT DESCRIPTION

2.1 Site Location and Surrounding Land Uses

The site, identified as Lot 591 DP 1191380, is located at 4226 Nelson Bay Road, Anna Bay, approximately 30 kilometres northeast of Newcastle (**Figure 1**). The site has an area of 13 hectares and is predominantly undeveloped. An existing shed is located at the northern end of the property, close to Nelson Bay Road, and an unsealed road extends north to south along the extent of the property. An electricity easement runs in an east to west direction through the southern portion of the property.



Figure 1: Site Location

The closest receivers to the site include the Baylife Church on the property immediately to the east of the proposal site and residential receivers adjacent to Nelson Bay Road. The Worimi National Park is located to the west of the proposal site, and the Birubi Beach foreshore is about 1 kilometre to the south of the proposal extent. There are commercial facilities, including a nursery and a service station about 700 metres to the east and the west of the proposal site respectively. A show ground and the Nelson Bay Pony Club are located east of the proposal site. There are three existing sand extraction quarries to the east of the proposal site also. **Figure 2** shows the surrounding land uses.

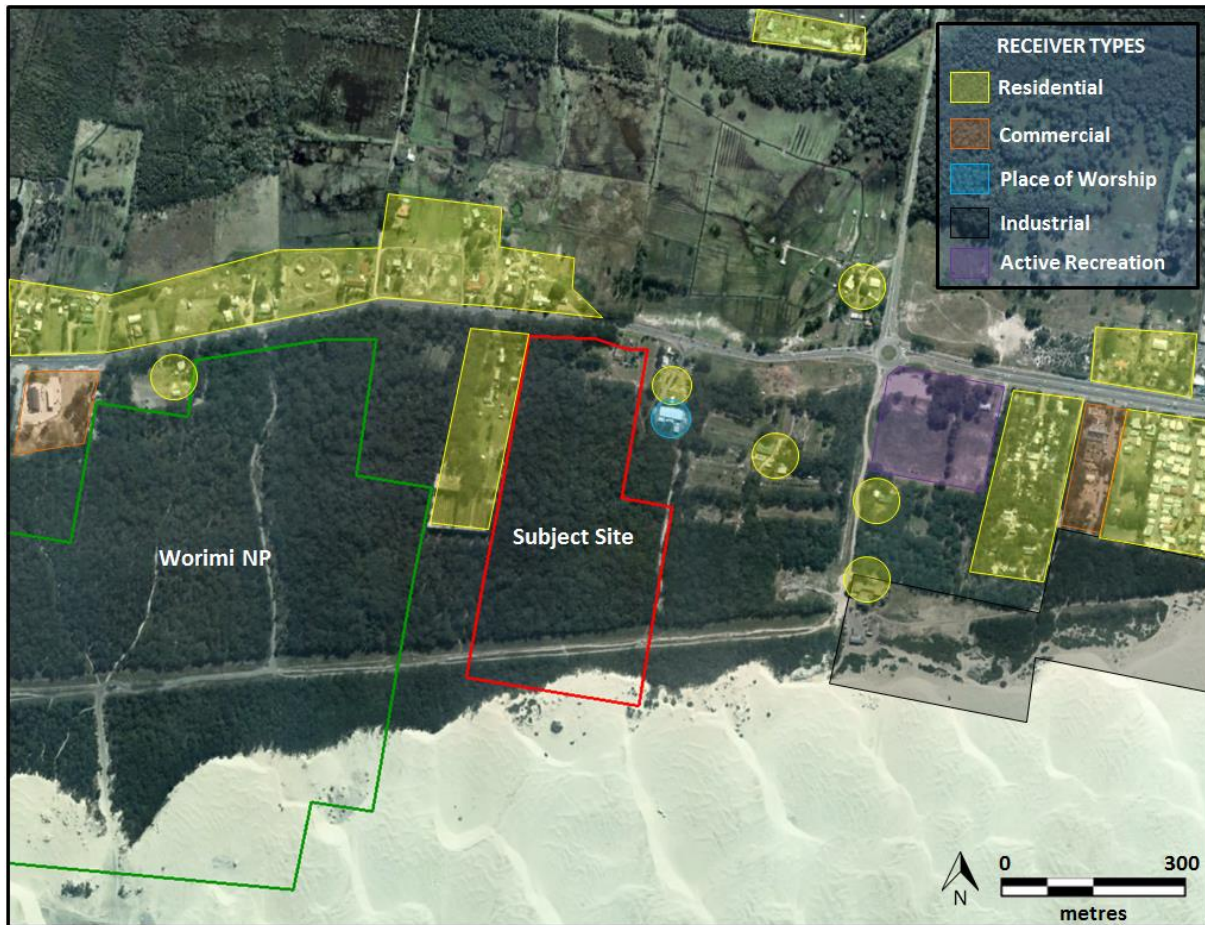


Figure 2: Sensitive land use types within study area

2.2 Project Overview

Approval is sought for the establishment and operation of a sand quarry, and ancillary facilities, at Anna Bay, approximately 30 kilometres northeast of Newcastle. The layout of the proposed facility is presented in **Figure 3**.

The proposed development would involve the extraction of sand from within and adjacent to an AusGrid electricity easement at the southern end of the property. At present, through the action of wind, sand accumulates within the electricity easement, under the 33kV electrical powerlines. AusGrid requires that the easement is kept clear to undertake legally required maintenance works. Hay Enterprises proposes to establish a sand quarry with a 30 year life span, and a maximum extraction rate of 50,000 cubic metres of sand annually. The proposal would assist AusGrid in their long term maintenance of the electricity easement.

The establishment of the sand quarry would involve minor vegetation clearing, widening and upgrading the existing unsealed internal road, the construction of a caretaker's residence, site office and machinery shed, and the improvement of the site access from Nelson Bay Road.



Figure 3: Layout of the proposed sand quarry facility

2.3 Proposed Operations

The proposed operation would involve the extraction of sand and direct removal off site on a per demand basis. A review of proposed site activities was undertaken in order to establish an inventory of significant noise generating plant and processes. These include:

- excavation of material using a front end loader;
- loading of sand to truck-and-dogs; and
- transport of material offsite;

The maximum extraction rate will be approximately 910 cubic metres of sand per day, with a maximum threshold of 50,000 cubic metres per annum. To achieve the maximum daily extraction rate, Advitech Environmental understands that there would be up to a maximum of 40 truck and dog movements per day (up to four per hour). It is anticipated that one additional vehicle movement (per hour) may occur in and out of the site, which would account for light vehicle movements, delivery of goods and removal of waste.

Heavy vehicles associated with the operation of the proposed facility will access the site from Nelson Bay Road. It is assumed that the majority of heavy vehicles (75%) will access the site from, and leave the site to, the south.

The proposed operating hours are 7:00am to 6:00pm Monday to Friday, and 8:00am to 2:00pm on Saturdays. The facility would be closed on Sundays.

The facility is proposed to be constructed over 1 to 2 months, across a number of stages. The construction is expected to involve vegetation removal and mulching, earthworks and site establishment, building assembly, and site access improvements. It is anticipated that the construction works would be undertaken during standard construction times (7:00 am to 6:00pm Monday to Friday).

3. THE EXISTING ENVIRONMENT

3.1 Sensitive Receiving Environments

Site inspection and review of aerial imagery indicate that the proposed development site is generally rural in nature; however, the site has frontage to Nelson Bay Road with characteristically heavy and continuous traffic flows during peak periods. Two distinct sensitive receiving environments adjacent to the proposed development site were identified, including:

1. receivers immediately adjacent to Nelson Bay Road (generally with frontage or shared boundary with the roadway); and
2. receivers setback from Nelson Bay Road (with or without frontage to Nelson Bay Road);

A combination of unattended background monitoring and short-term operator attended noise monitoring was undertaken in each of these receiving environments to characterise existing noise levels. These data were used to derive PSNL for the development. As heavy and continuous through traffic was observed to be a feature of the locality, all receiving environments were characterised as representative of the Urban Residential receiver type established in the INP.

3.2 Assessment of Existing Noise Levels

Environmental noise monitoring was undertaken at two locations to measure ambient and background noise levels in receiving environments adjacent to the proposed development site (**Figure 4**). The monitoring locations were selected such as to be representative of typical receiver locations in these receiving environments.

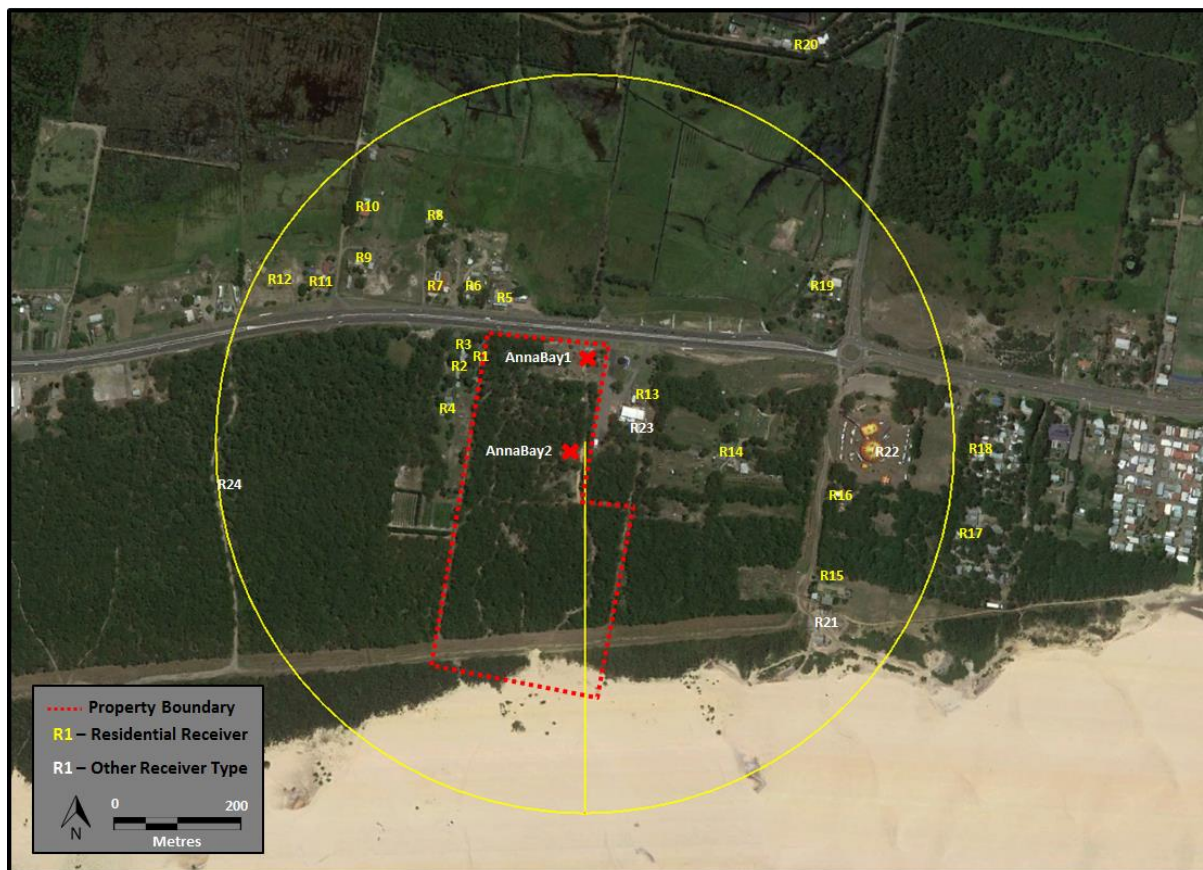


Figure 4: Sensitive receivers and noise monitoring locations

The noise monitoring was carried out using two ARL-EL-316 Type 1 Environmental Noise Loggers. The logger calibrations were checked before and after the measurement period, with no significant drift (± 0.5 dB) noted. Details relevant to the background noise monitoring are provided in **Table 1**.

Table 1: Details of background monitoring

Location	Adjacent to Nelson Bay Road (RecEnv1)	Setback Receivers (RecEnv2)
Logger Serial Number	ARL316 (s/n:16-203-513)	ARL316 (s/n:16-299-450)
Measurement Title	AnnaBay1	AnnaBay2
Run Started	1/02/18 14:00	1/02/18 14:00
Run Stopped	14/02/18 13:30	14/02/18 13:30
Frequency Weighting	A	A
Time Response	Fast	Fast
Engineering Units	dB SPL	dB SPL

The noise levels obtained from the continuous noise logging (presented graphically in **Appendix I**) are expressed in terms of, $L_{A90,15\text{minute}}$ and $L_{Aeq,15\text{minute}}$.

- $L_{A90,15\text{minute}}$ is the A-weighted noise level that is exceeded for 90% of the monitoring time period (15 minutes).
- The $L_{Aeq,15\text{minute}}$ is the 15 minute equivalent continuous noise level containing the same acoustic energy as the actual fluctuating noise level.

The $L_{A90,15\text{minute}}$ descriptor is commonly referred to as the background noise level and the lowest 10th percentile $L_{A90,15\text{minute}}$ over a period (day, evening, night) is referred to as the period assessment background level (ABL). The Rating Background Level (RBL) for each assessment period of the monitoring occurrence is then calculated by taking the median of the ABLs.

Supplementary local meteorological monitoring (rain, wind speed and direction) was undertaken using a Davis Vantage Vue Precision Weather Station at the monitoring location set back from Nelson Bay Road (AnnaBay2). This data is used to validate noise monitoring results in accordance with provisions established in Section 5 of the INP.

3.2.1 Noise Monitoring Results

The Rating Background Level (RBL) and associated Intrusiveness Criteria were determined for the receiving environments adjacent to the proposed development in accordance with provisions established in the INP. The results of this analysis are presented in **Table 2**.

Table 2: Details of background monitoring (Day period 7:00 to 6:00pm)

Date	Adjacent to NBR (AnnaBay1)	Setback Receivers (AnnaBay2)
	Day	Day
1/02/2018	-	-
2/02/2018	51	46
3/02/2018	50	47
4/02/2018	49	45
5/02/2018	-	-
6/02/2018	48	43
7/02/2018	50	43
8/02/2018	49	44
9/02/2018	51	43
10/02/2018	47	41
11/02/2018	43	39
12/02/2018	49	42
13/02/2018	49	44
14/02/2018	47	40
Rating Background Level (RBL)	49	43
Mean L_{Aeq}	60	54

Assessment of monitoring results is presented for the day period (7:00 to 6:00pm) only, as the development is not proposed to operate during the evening or night periods. Periods for which Assessment Background Levels (ABL) are not presented were omitted from the analysis based on the data exclusion rules outlined in Appendix B of the INP.

Short term attended monitoring was also undertaken at each of the monitoring locations on 1 February, 2018 during the day period, as a means of characterising the ambient noise sources within the receiving environments. The attended monitoring was undertaken using a Svantek (SVAN) 958, Type 1 sound level meter (SLM) (S/N:20777), with the results of the monitoring detailed in **Table 3**.

Table 3: Attended Monitoring Results, dB(A)

Location	Date	Time	L _{A10}	L _{Aeq}	L _{A90}	Comments
AnnaBay1 (Adjacent to NBR)	1/02/18	12:57	58	55	51	Bird Chatter up to 73 dB(A) Road Noise up to 60 dB(A)
AnnaBay2 (Setback Receivers)	1/02/18	12:23	57	54	50	Bird Chatter up to 65 dB(A) Road Noise up to 69 dB(A)

Existing industrial facilities within the locality of the study site, including other sand mining operations, were not audible at any time during the attended noise monitoring events.

3.3 Assessment of Prevailing Meteorology

The INP identifies that meteorological conditions such as wind gradients and temperature inversions may enhance noise propagation from industrial sites to distant sensitive receivers. The guide provides two options for the assessment of these impacts:

- a simple method, which adopts worst case noise enhancing conditions;
- a more detailed analysis of prevailing meteorology, to identify whether enhancing conditions occur with sufficient frequency to be considered a feature of the local environment:
 - where enhancing conditions occur with sufficient frequency, noise enhancing meteorological parameters should be adopted by the noise modelling;
 - where enhancing conditions are not a feature of the environment, modelling should adopt the standard meteorological parameters.

The INP sets the threshold of significance at 30% of the time during any assessment period, assessed seasonally.

The nearest Bureau of Meteorology (BoM) Automatic Weather Station (AWS) is located at Nelson Bay, approximately 11km northeast of the proposed development site. Monthly climate statistics between 1968 and 2010 were analysed to identify whether any prevailing wind patterns may be considered a feature of this environment. Wind is considered to be a feature of the environment where source to receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time of more in any assessment period, in any season.

The results of the analysis of monthly climate statistics indicated that prevailing winds were not observed for more than 30% of the time during any season. Prevailing winds are therefore not considered a significant feature of this environment, and neutral meteorological conditions were applied to the assessment of noise propagation.

As temperature inversions are usually only prominent during sunset and sunrise, there is no need to consider their effect for a development that does not operate at night. Therefore, temperature inversions have not been considered within this assessment.

4. NOISE ASSESSMENT CRITERIA

4.1 Construction Noise

The NSW *Interim Construction Noise Guideline* (ICNG) (2009) provides guidance on managing construction works to minimise noise, with an emphasis on communication with, and cooperation from all stakeholders affected by construction noise. The framework identifies the following steps for managing construction noise impacts:

- identify any sensitive land uses that may be affected;
- identify the operating hours and duration of the proposed construction works;
- determine the noise impacts at sensitive receivers; and
- select and apply the best work practices to minimise noise impacts.

The quantitative noise assessment approach is applied to larger construction projects, anticipated to extend for a period greater than three weeks. This approach involves predicting noise levels from construction activities, and comparing them to Noise Management Levels (NML), as per Table 2 of the ICNG, reproduced as **Table 4** below.

Table 4: Noise at Residences (Quantitative Assessment) from ICNG (DECC, 2009)

Time of Day	Management Level, $L_{Aeq}(15\text{ min})$	How to apply
Recommended standard hours:	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise.
Monday to Friday 7 am to 6 pm		Where the predicted or measured $L_{Aeq}(15\text{ min})$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level.
Saturday 8am to 1 pm		The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration as well as contact details.
No work on Sundays or public holidays	Highly Noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 3. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 4. if the community is prepared to accept a longer period of construction in place of restrictions on construction times.

A summary of the construction noise management levels (NMLs) specific to this project are provided in **Table 5**. The NMLs for residential receivers are based on the unattended background noise levels summarised in **Table 2**. It should be noted that the ICNG recognises that the potential long term benefits of some construction works may offset short term amenity losses. On this basis, the NML are not statutory criteria above which impacts are deemed to be non-compliant, but the level at which reasonable and feasible management measures would be required.

Table 5: Construction Noise Management Levels ($L_{Aeq, (15 \text{ min})}$)

Receiver Type	Recommended Standard Hours	Management Level ($L_{Aeq, (15 \text{ min})}$)	
Residential Receivers	Monday to Friday: 7am to 6pm	Noise Affected NML (RBL + 10)	53 - 59
	Saturday : 8am to 1pm	Highly Noise Affected NML	75
Places of Worship	Applies when property is being used	Internal NML	45
Areas of Active Recreation		External NML	65
Areas of Passive Recreation		External NML	60
Industrial Receivers		External NML	75

4.2 Operational Noise Criteria

The INP presents two criteria for the assessment of industrial noise sources, intrusive noise impacts and amenity noise levels. In assessing the noise impact of industrial sources, both components are considered for sensitive receivers. Typically, the more stringent of these criteria would be applied as the Project Specific Noise Level (PSNL) for the development as a means of managing intrusive noise impacts and preserving the amenity of the receiving environment.

4.2.1 Intrusive Noise Impacts

The intrusiveness of an industrial noise source is generally considered acceptable if the predicted $L_{Aeq, 15 \text{ minute}}$ impact does not exceed the background noise level by more than 5 dB when measured in the absence of the source. The background noise level, or Rating Background Level (RBL), is determined in accordance with Section 3 of the INP and is the median value of the Assessment Background Levels (ABL) determined for the monitoring period. The use of the median accounts for noise level variations over time. The intrusiveness criterion is equal to the RBL + 5dB.

4.2.2 Amenity Noise Level

To limit continuing increases in noise levels, the EPA has identified recommended maximum ambient noise levels for typical receiver areas and land uses. The relevant section of *Table 2.1* of the INP has been reproduced as **Table 6**. The locality of the study area is described as rural in nature; however, as heavy and continuous through traffic was observed to be a feature of the locality, all receiving environments were characterised as representative of the Urban Residential receiver type established in the INP.

Where the existing noise level from industrial sources is close to the acceptable noise level (ANL), the noise level from any new source(s) must be controlled to preserve the amenity of the area. If the total noise level from industrial sources already exceeds the ANL for the area in question, the L_{Aeq} noise level from any new source should not be greater than 10 dB below the acceptable noise level if there is reasonable expectation that existing levels may be reduced in the future; or 10 dB below the existing level if there is no such reasonable expectation that existing levels will fall. *Table 2.2* of the INP (reproduced as **Table 7**) sets out implications and adjustment requirements for noise from industrial sources.

Table 6: Recommended L_{Aeq} noise levels from industrial noise sources

Type of Receiver	Indicative Noise Amenity Area	Time of Day	Recommended Acceptable Level dB(A)	Recommended Maximum dB(A)
Residential	Urban	Day	60	65
		Evening	50	55
		Night	45	50
Place of worship - internal	All	When in use	40	45
Passive recreation			50	55
Active recreation			55	60
Industrial Premises			70	75

Source: Environment Protection Authority INP Table 2.1 (2000)

Table 7: Modification to acceptable noise levels (ANL) to account for existing level of industrial noise

Total existing L_{Aeq} noise level from industrial sources, dB(A)	Maximum L_{Aeq} noise level for noise from new sources alone, dB(A)
$\geq$ Acceptable noise level plus 2	If existing noise level is <i>likely to decrease</i> in the future: Acceptable noise level minus 10. If existing noise level is <i>unlikely to decrease</i> in the future: Existing noise level minus 10
Acceptable noise level plus 1	Acceptable noise level minus 8
Acceptable noise level	Acceptable noise level minus 8
Acceptable noise level minus 1	Acceptable noise level minus 6
Acceptable noise level minus 2	Acceptable noise level minus 4
Acceptable noise level minus 3	Acceptable noise level minus 3
Acceptable noise level minus 4	Acceptable noise level minus 2
Acceptable noise level minus 5	Acceptable noise level minus 2
Acceptable noise level minus 6	Acceptable noise level minus 1
< Acceptable noise level minus 6	Acceptable noise level

4.2.3 Modifying Factor Adjustments

Where a noise source contains certain characteristics, such as tonality, impulsiveness, intermittency, or dominant low frequency content, the “unusual” noise may cause greater annoyance than other noise at the same level. On the other hand, noise levels from a single event of a short duration, may cause less annoyance to nearby sensitive receivers. In such circumstances, a modifying factor should be applied to the acceptable noise level at the nearby sensitive receivers.

It is considered that normal operational activities would not generate unusual noise characteristics. Furthermore, Advitech Environmental understands that tonal reverse alarms would not be used in mechanical plant on the proposal site. Therefore, no modification factors have been applied for tonality, impulsive noise or low frequency noise.

4.2.4 Project Specific Noise Levels

Project specific noise levels (PSNLs) for the development are assigned after determining the relevant noise levels from the intrusiveness and amenity criteria, and set the benchmark against which noise impacts and the need for noise mitigation are assessed. **Table 8** provides an assessment of the acceptable noise levels, and establishes the PSNLs relevant to the project.

Table 8: Assessment of PSNL in adjacent receiving environment

Receiver Type	Period	Amenity	RBL	Intrusiveness	PSNL dB(A)
		Recommended Acceptable ANL $L_{Aeq,period}$		Criteria $L_{Aeq,15min}$	
Residential (RecEnv1)	Day	60	49	54	54 ($L_{Aeq,15min}$)
Residential (RecEnv2)	Day	60	43	48	48 ($L_{Aeq,15min}$)
Place of Worship ¹		40	-	-	40 ($L_{Aeq,period}$)
Passive Recreation	When in use	50	-	-	50 ($L_{Aeq,period}$)
Active Recreation		55	-	-	55 ($L_{Aeq,period}$)
Industrial		70	-	-	70 ($L_{Aeq,period}$)

Note 1: Existing industrial noise sources not audible during attended monitoring. Therefore, no modification to ANL

4.2.5 Road Traffic Noise Criteria

The NSW RNP (2011) provides a framework for the management of noise issues associated with road traffic from existing roads, new road projects, road redevelopment projects and new traffic-generating developments. The primary aim of the RNP is to provide assessment criteria for road traffic noise based on protecting amenity and wellbeing.

The criterion adopted for this assessment is provided in **Table 9**. This is based on review of existing receiving environments, and description of road types established in the RNP. Calculated contributions from road traffic generated by the proposed development may be compared against management levels (or existing traffic noise levels) to assist with evaluation of potential project related impacts.

Table 9: Road traffic noise assessment criteria for residential land uses

Road Category	Type of Project / Land Use	Assessment Criteria - dB(A)
		Day 7:00am - 10:00pm
Freeway / arterial / sub-arterial roads	Existing residences affected by additional traffic on existing freeways / arterial / sub-arterial roads generated by land use developments	$L_{Aeq, (15hour)}$ 60 (external)

5. NOISE LEVEL ASSESSMENT

5.1 Methodology

A model of the construction phase and operational noise impacts was constructed using the ISO9613 calculation methodology in the *Predictor* environmental noise modelling software, with consideration to the CONCAWE sub-method to evaluate meteorological influences. Predictor is an environmental noise mapping package that facilitates calculation of noise impacts, accounting for source receiver relationships, terrain and meteorological affects. To assess the potential noise impacts, predictions derived through the noise modelling are presented against the relevant noise criteria.

The modelled impact of the proposed activities is based on the Sound Power Level (SWL) and location of noise sources within the proposed works area. Third-octave (1/3 octave) SWL data representative of the proposed works were used as model inputs. These data were sourced from:

- the UK Department of Environment, Food and Rural Affairs (DEFRA, 2005);
- AS 2436-2010: Guide to noise and vibration control on construction, demolition and maintenance sites; and
- the Advitech Environmental noise source library, including SWL measurements of processes at similar operations.

Sensitive receiver locations were selected to be indicative of the potentially worst affected receivers within the noise environments. A review of receivers in the locality found that the dwelling types were typically single storey residences. The receiver heights were therefore modelled at 1.5 metres. Residential and industrial receivers were assessed at the potentially most affected location on the site boundary, while the internal noise levels of a nearby church were assessed using a conservative attenuation of 10 dB as per the INP.

5.2 Construction Phase Scenarios

The construction phase of the proposal is expected to last between 1 to 2 months, and be completed over multiple stages. The construction works are expected to occur during standard hours 7:00am to 6:00pm Monday to Friday, with no works to be undertaken on weekends.

A summary of SWL for plant utilised during site construction phase activities are shown in **Table 10**. The specific work phases during the construction period would include:

- Vegetation removal and mulching;
- Improvement and widening works to the existing haul road;
- Site preparation including the placement and spreading of base material for the construction of the site shed;
- Installation of formwork and the pouring of the concrete slab; and
- Construction of the caretaker's residence, site office and machinery site shed.

In addition to the site construction activities, upgrade works would be required to the site access to provide safe ingress and egress. These upgrade works would involve the widening Nelson Bay Road to allow for the construction of a turning lane. Specific construction works would include formation widening works and asphalt paving works.

Table 10: Construction Noise Sources

Construction Phase	Plant Description	A-wt Level
Site Construction Activities		
Vegetation Removal	Chainsaw	114
	Mulcher	116
	Excavator	105
Haul Road Improvements	Truck & Dog	106
	Excavator	105
	Grader	112
Site Preparation	Excavator	105
	Truck & Dog	106
Concrete Foundations	Hand Tools	102
	Concrete Truck	108
	Concrete Pump	103
	Concrete Screen	91
Construction of site structures	Delivery Truck	101
	Franna	103
	Hand Tools	102
Site Access Construction Activities		
Formation Widening	Truck & Dog	106
	Excavator	105
	Grader	112
	Compactor	109
	Roller	107
	Water Cart	107
Paving Works	Asphalt Paver	114
	Asphalt Sprayer	104
	Smooth Drum Roller	107
	Truck & Dog	107

5.3 Operational Phase Scenarios

A summary of SWL for plant utilised during operational phase activities are shown in **Table 11**. Multiple operational phase modelling scenarios were constructed to evaluate the potential noise impacts, including:

- premises based operational noise associated with:
 - combined operation of the quarry and movement of heavy vehicles within the boundary of the development site; and
 - mulching of vegetation removed during quarrying processes; and
- road traffic noise associated with the movement of heavy vehicles along the public access roads to the site.

Table 11: Operational stage noise sources

Plant Description	Description of Utilisation	A-wt Level
Front End Loader	Loading material into heavy vehicles	107 dB
Truck & Dog	Transport of material from site	106 dB
Mulcher	Occasional mulching of vegetation	116 dB

5.4 Model Assumptions

Modelling scenarios were established to provide a conservative assessment for operations at the facility over a 15 minute period. The predicted results for each scenario represent the upper limit of expected noise levels from the proposed facility.

Key assumptions of the model include:

- all ground surfaces were modelled considering a ground factor of 0.5. It is noted that the land surface between the proposal site and the sensitive receiver locations is generally forested, therefore the modelled ground factor is considered to be conservative;
- the land surface was modelled as a flat surface. It is noted that the natural dune system would provide natural shielding to some sensitive receivers;
- all residential receivers were modelled at 1.5 metres above the ground surface;
- all noise sources were considered to operate at their maximum assumed noise levels for the duration of the assessment period;
- all noise sources were considered to operate simultaneously;
- all noise sources were modelled as point sources except for truck and dogs, and delivery trucks, which were modelled as a moving source at a speed of 20 km/hr;
- a peak number of trucks moving on site of 4 per hour (8 vehicle movements) for removal of sand off site, and 1 additional truck per hour (2 vehicle movements) for removal of waste or delivery of equipment, at a speed of 20 km/hr;
- no modifying factors have been applied to noise source sound power levels (SWLs) as tonal influences are not considered to be a feature of the operational noise environment.

It must be noted that these represent conservative assumptions, and the modelling results represent the upper limit of expected noise levels.

5.5 Noise Level Predictions

5.5.1 Construction Phase

A summary of predicted $L_{Aeq,15\text{minute}}$ noise levels at the nearest sensitive receivers associated with each of the construction phase scenarios are provided in **Table 12**. The predicted results are summarised by receiver type. Noise level contours for each of the construction phase scenarios are provided in **Appendix II**.

Table 12: Worst case noise impact predictions ($L_{Aeq,15\text{minute}}$ dB(A))

Scenario	Receiver Type	ID of most Affected Receiver	Prediction $L_{Aeq,15\text{minute}}$	NML $L_{Aeq,15\text{minute}}$	Count Receivers > NML
Vegetation Removal Including Mulching	Residential	R13	52	53-59	0
	Church	R23	42 ¹	45 (internal)	0
	Recreation	R22	47	60-65	0
	Industrial	R21	52	75	0
Haul Road Widening and Improvements	Residential	R13	67	53-59	2 (R13, R14)
	Church	R23	55 ¹	45 (internal)	1 (R23)
	Recreation	R22	48	60-65	0
	Industrial	R21	46	75	0
Site Preparation	Residential	R13	46	53-59	0
	Church	R23	36 ¹	45 (internal)	0
	Recreation	R22/R24	39	60-65	0
	Industrial	R21	42	75	0
Concrete Foundations	Residential	R13	46	53-59	0
	Church	R23	36 ¹	45 (internal)	0
	Recreation	R22/R24	37	60-65	0
	Industrial	R21	40	75	0
Shed Construction	Residential	R14	42	53-59	0
	Church	R23	32 ¹	45 (internal)	0
	Recreation	R22/R24	37	60-65	0
	Industrial	R21	41	75	0
Formation Widening	Residential	R13	64	53-59	3 (R5, R13, R14)
	Church	R23	51 ¹	45 (internal)	1 (R23)
	Recreation	R22	50	60-65	0
	Industrial	R21	46	75	0
Paving Works	Residential	R13	64	53-59	5 (R1, R5, R8, R13, R14)
	Church	R23	51 ¹	45 (internal)	1 (R23)
	Recreation	R22	51	60-65	0
	Industrial	R21	48	75	0

Note 1: Denotes predicted internal noise level

The results of noise modelling for site preparation and construction works indicate that:

- during haul road widening works, exceedences of the day period NML may be expected for:
 - two residential receivers, including R13 (14 dB) and R14 (2 dB);
 - one place of worship (R23) with predicted internal noise levels 10 dB above the NML;
- there were no receivers predicted to experience noise levels above the highly affected NML of 75 dB(A); and
- emissions associated with vegetation removal, site preparation, foundation works and shed construction are expected to be below the relevant NMLs at all receiver locations.

During site access construction works, involving the widening of Nelson Bay Road to allow a left turn lane into the proposed facility, and road paving works, the results of the modelling indicate that:

- three residential receivers would potentially experience noise levels, during formation widening works, that exceed the day period NMLs by up to 11 dB at R13, and up to 2 dB at R5 and R14;
- five residential receivers would potentially experience noise levels, during paving works, that exceed the day period NMLs by up to:
 - 11 dB at R13;
 - 3 dB at R5 and R14; and,
 - 1 dB at R1 and R8;
- an exceedences of the internal NML, for a place of worship, was predicted of up to 7 dB at R23 (Baylife Church);
- there were no predicted exceedences of the NML for recreation or industrial receivers.

The predicted noise levels represent conservative assumptions, based on all plant operating at maximum capacity, and at locations most exposed to the nearby sensitive receivers. Where plant do not work simultaneously and are not at their closest point, lower noise levels would be expected. It is therefore considered that these modelled predictions represent the upper limit of expected noise levels.

It should be noted that many of the items of plant proposed for the construction phase activities have the potential to generate tonal influences, particularly in the case of reverse alarms. Where tonal reverse alarms are used in lieu of broadband reverse alarms, the predicted noise levels are expected to be up to 5 dB higher than those modelled.

In light of the predicted exceedances at nearby residential receivers and the Baylife Church under specific construction scenarios, noise mitigation and management measures will be implemented. Some practical methods for managing the potential impacts will include:

- early and ongoing communication with potentially affected receivers to inform of the proposed works, duration and potential for noise;
- training workers to minimise noise by avoiding shouting; minimising slamming vehicle doors; avoiding the use of radios or stereos outdoors where neighbours can be affected;
- keeping truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours or other relevant practices;

- avoiding operating equipment simultaneously, where possible. This has the potential to substantially reduce noise emissions;
- designing of the site to avoid the use of reverse alarms or employ the use of broadband alarms to reduce the occurrence of any annoying characteristics;
- regular inspection and maintenance of equipment to ensure it is good working order;
- placing as much distance between plant or equipment and other sensitive land uses; and
- scheduling works to occur when neighbours are not present, or during times of high background noise to provide masking or reduce the amount that the construction noise intrudes above the background.

Although noise exceedences may be expected under haul road widening and turning lane improvement works, the activity will occur only for a relatively short term, and impacts will be minimised through the implementation of the above measures. Where noise complaints are received during the construction period, noise monitoring may be undertaken to confirm the nature of the complaint, and where required, confirm the need for any additional specific mitigation measures.

5.5.2 Operational Phase

A summary of predicted $L_{Aeq,15\text{minute}}$ noise levels at the nearest sensitive receivers associated with each of the operational scenarios are provided in **Table 13**. The predicted results are summarised by receiver type. Noise level contours for each of the operational stage scenarios are provided in **Appendix II**.

Table 13: Worst case noise impact predictions ($L_{Aeq,15\text{minute}}$ dB(A))

Scenario	Receiving Environment	ID	Prediction $L_{Aeq,15\text{minute}}$	PSNL $L_{Aeq,15\text{minute}}$	Count Receivers > PSNL
Quarry Operations (Front End Loader and Truck & Dogs)	Residential	R13	49	48-53	1 (R13)
	Church	R23	39 ¹	40 (internal)	0
	Recreation	R22	40	50-55	0
	Industrial	R21	43	70	0
Quarry Operations including Vegetation Mulching	Residential	R13	51	48-53	3 (R4, R13, R14)
	Church	R23	42	40 (internal)	1 (R23)
	Recreation	R22	45	50-55	0
	Industrial	R21	49	70	0

The results of noise modelling indicate that:

- a marginal exceedence of up to 1 dB above the day period criterion may be expected at residential receiver location R13 during general quarry operations;
- exceedences of 1 to 3 dB above the day period criterion may be expected at the residential receivers during vegetation mulching activities, where they occur concurrently with general quarry operations; and
- an exceedence of up to 2 dB above the day period criterion for internal noise at a place of worship may be expected at the Baylife Church (R23), where vegetation mulching and general quarry operations are occurring concurrently.

The results of the noise modelling indicate that the movement of vehicles on the internal haul road is the predominant activity contributing to the marginal exceedence of the day period criterion at residential receiver location R13 during general quarrying operations. In the absence of truck movements along the haul road, sand extraction activities were predicted to comply with the noise goals at each of the sensitive receiver locations.

During vegetation mulching activities, noise levels are predicted to increase at each of the receiver locations, with exceedences expected at three residential receivers (R4, R13 and R14), and the Baylife Church. It is noted that vegetation mulching activities would be an occasional practice at the site, occurring only when vegetation is uncovered from within the sand resource during quarrying operations.

In light of the predicted exceedences at nearby sensitive receivers under general quarrying operations and occasional vegetation mulching scenarios, noise mitigation and management measures will be implemented where reasonable and feasible. Advitech makes the following recommendations to manage noise levels from site activities:

- during quarrying operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day; and
- additional analysis shown in **Figure 5** indicates that background noise levels generally fall to their lowest between 11:00am and 3:00pm. High noise generating activities such as mulching should be scheduled for periods of higher background noise levels, during which masking of noise is more likely to occur.

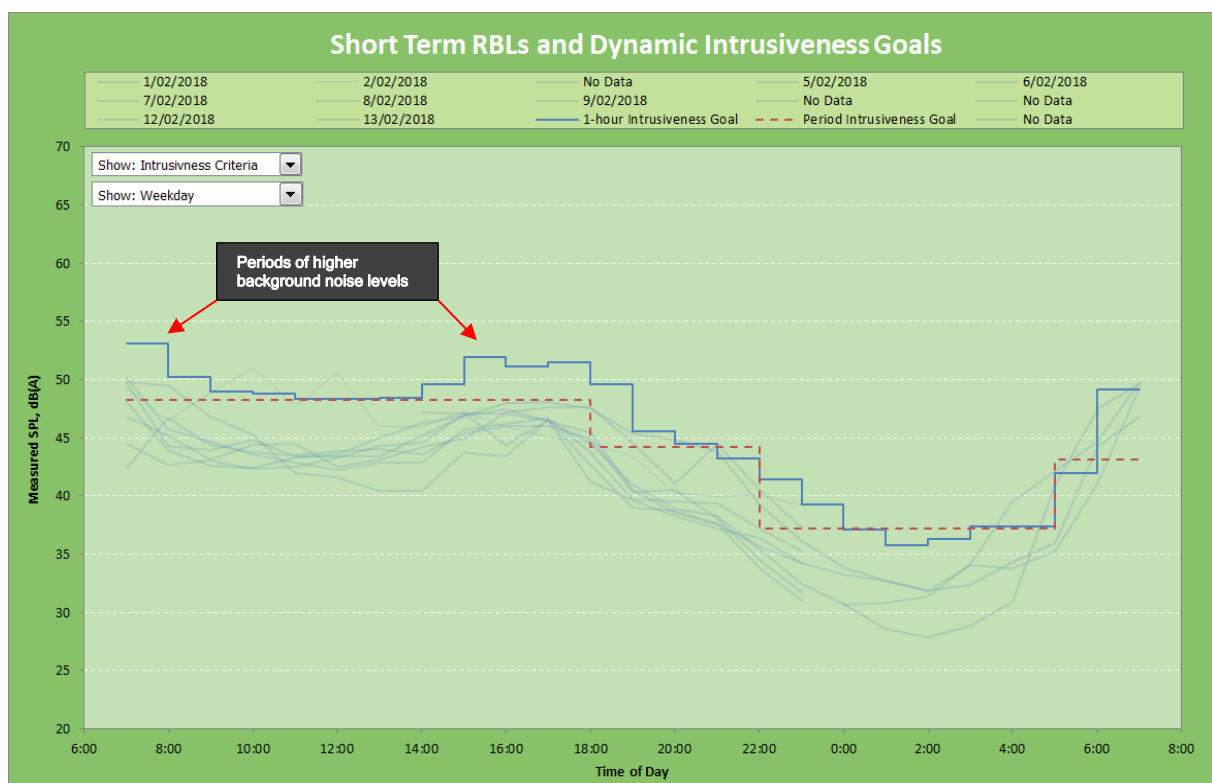


Figure 5: Analysis of short term (hourly) RBLs and Dynamic Intrusiveness Goals

Upon implementation of the noise mitigation and management measures, noise monitoring is to be carried out to establish the noise emission level of the facility at sensitive receivers and determine compliance. It is recommended that noise monitoring is undertaken on a quarterly basis for the facility's first year of operation, with the frequency of noise monitoring reviewed each year afterwards.

Monitoring should also be carried out in response to a complaint and should be completed as soon as practically possible after the complaint. Where applicable, following any corrective action, monitoring should be repeated to confirm the effectiveness of any control measure implemented.

5.6 Road Traffic Noise Assessment

Project generated traffic has the potential to increase noise levels on existing public roads. For sensitive land uses affected by additional traffic on existing roads, generated by land use developments, any increase in the total traffic noise levels should be limited to 2 dB above that of the corresponding 'no build option'.

Vehicle movements would be determined by product demand and the availability of the resource. At present, the existing sand resource is approximately 37,100 cubic metres, therefore the annual volume to be extracted would be significantly less than the maximum threshold extraction rate of 50,000 cubic metres per year. Notwithstanding this, the road traffic assessment has assumed a maximum number of vehicle movements based on the threshold production rate. The road traffic noise assessment was based on the following parameters:

- an assumed maximum of 4 heavy vehicles accessing and exiting the site per hour;
 - this figure was established by dividing the maximum number of production vehicles per day (40) by the operating hours in each day (10 hours);
- it is anticipated that there would be a 75% / 25% split of vehicles accessing and departing the site via Nelson Bay Road from the west / east respectively; and
- the sign posted speed limit on Nelson Bay Road is 90km/h.

It is anticipated that one additional vehicle movement would occur per hour in and out of the site, which would account for light vehicle movements, delivery of goods and removal of waste.

Nelson Bay Road is the main arterial link connecting Newcastle to Williamstown and the Tomaree Peninsula. It carries a large volume of local and tourist traffic visiting the Nelson Bay area. It is the only route servicing the Tomaree Peninsula and the various townships between Newcastle and Nelson Bay. Based on a traffic survey undertaken by Trans Traffic Survey between 6 February 2018 and 13 February 2018, the existing traffic volumes on Nelson Bay Road are approximately 19,100 vehicles per day, with approximately 6% heavy vehicles.

As Nelson Bay Road is the main arterial road servicing the Tomaree Peninsula, carrying a high volume of existing traffic including heavy vehicles, it is expected that the maximum traffic generated by the proposed development would be less than 0.5% of AADT.

Typically an increase in traffic noise level above the 2 dB increase criteria is expected where traffic volumes increase by 20% or more. Since the project is expected to increase traffic by a much lower amount than this, it is considered to comply with the RNP relative increase criteria.

6. CONCLUSION

Advitech Environmental was engaged to prepare an assessment of potential noise impacts associated with the construction and operation of a proposed Sand Quarry at Nelson Bay Road, Anna Bay. The construction period is anticipated to take approximately one to two months, with construction activities being undertaken during weekdays from 7:00am to 6:00pm. The development is proposed to operate between the hours of 7:00am and 6:00pm Monday to Friday, and 8:00am to 1:00pm Saturdays. The operation will produce up to 50,000 cubic metres of quarried material per annum.

Noise assessment criteria were established for adjacent sensitive receiving noise environments. Assessment of potential construction and operational phase noise impacts was made using a number of conservative assumptions as outlined in the report. The noise prediction indicates that exceedances of the noise goals may be expected under some construction and operational conditions.

During construction, exceedance of the NMLs at up to five residential receivers and one place of worship may be expected during internal haul road widening works and the works to improve the site access. It is expected that there would not be any exceedance of the *high affected* NMLs during any of the construction activities. Noise impacts would be minimised during the construction phase of the proposal by implementing the recommended work practices provided within this report. Supplementary monitoring may be undertaken in response to, and to assist with the management of specific noise complaints.

During operation, marginal exceedances of the PSNLs at up to three residential receivers and one place of worship may be expected during general quarrying operations and vegetation mulching activities. In addition to universal work practices to minimise the site generated noise, the following noise control recommendations are provided to minimise noise emissions during the operational phase of the proposal:

- during quarrying operations, internal vehicle movements are restricted to four heavy vehicles in any one hour of the day;
- noise levels generally fall to their lowest between 11:00am and 3:00pm. High noise generating activities such as mulching should be scheduled for periods of higher background noise levels, during which masking of noise is more likely to occur.
- temporary barriers or local topography may be used to maximise the shielding of the nearby sensitive receivers from vegetation mulching activities.

It is anticipated that the maximum traffic volumes generated by the proposed development would be less than 0.5% of AADT, therefore, it is considered that no significant increase of road traffic noise is expected on Nelson Bay Road as a result of the proposal.

7. REFERENCES

The following information was used in the preparation of this report:

1. AS 2436-2010: *Guide to noise and vibration control on construction, demolition and maintenance sites*.
2. AS 2706-1984: *Numerical Values: Rounding and interpretation of limiting values*;
3. Bies, DA & Hansen, CH (2009). *Engineering Noise Control: Theory and Practice* (4th Edition), Spon Press;
4. NSW Department of Environment and Climate Change (2009), *Interim Construction Noise Guideline*, Department of Environment and Climate Change, Sydney.
5. NSW Department of Environment, Climate Change and Water (2011), *NSW Road Noise Policy*, Department of Environment, Climate Change and Water, Sydney.
6. NSW Environment Protection Authority (2000). *NSW Industrial Noise Policy*, NSW Environment Protection Authority, Sydney;
7. UK Department of Environment, Food and Rural Affairs (2005), *Update of noise database for prediction of noise on construction and open sites*, UK Department of Environment, Food and Rural Affairs, Norwich.



Appendix I

Background Noise Monitoring

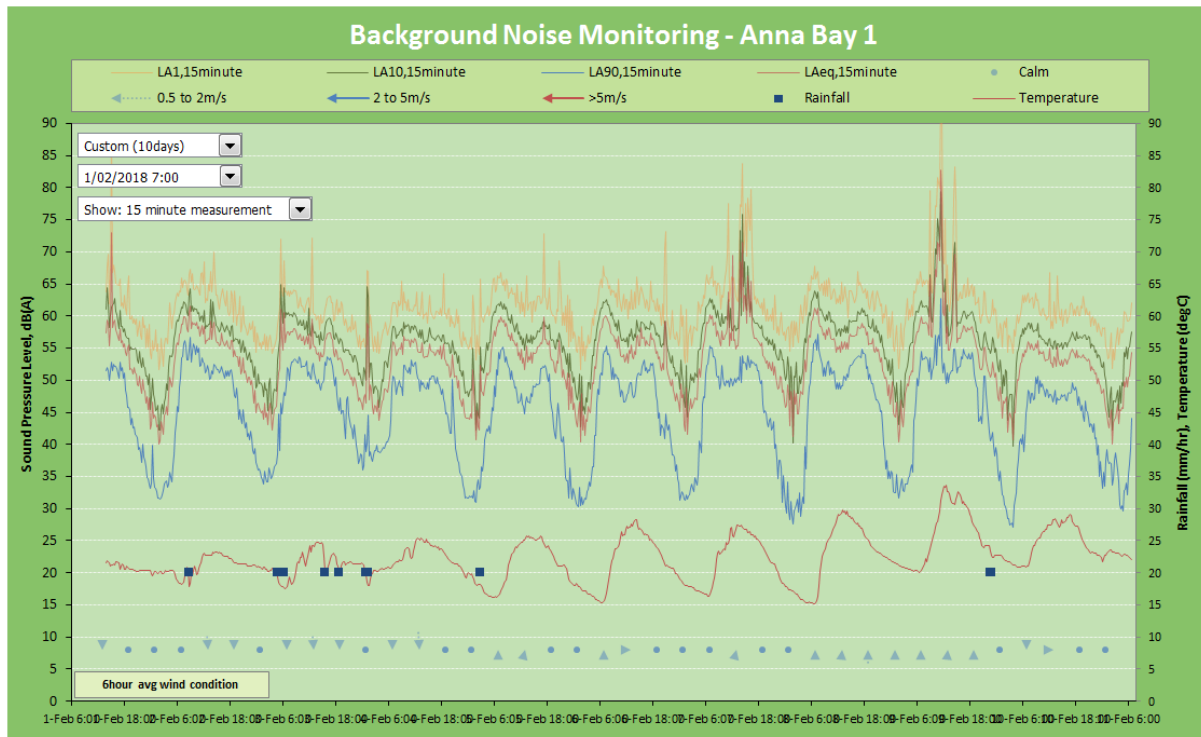


Figure I-1: Background noise monitoring at location Anna Bay 1, adjacent to Nelson Bay Road

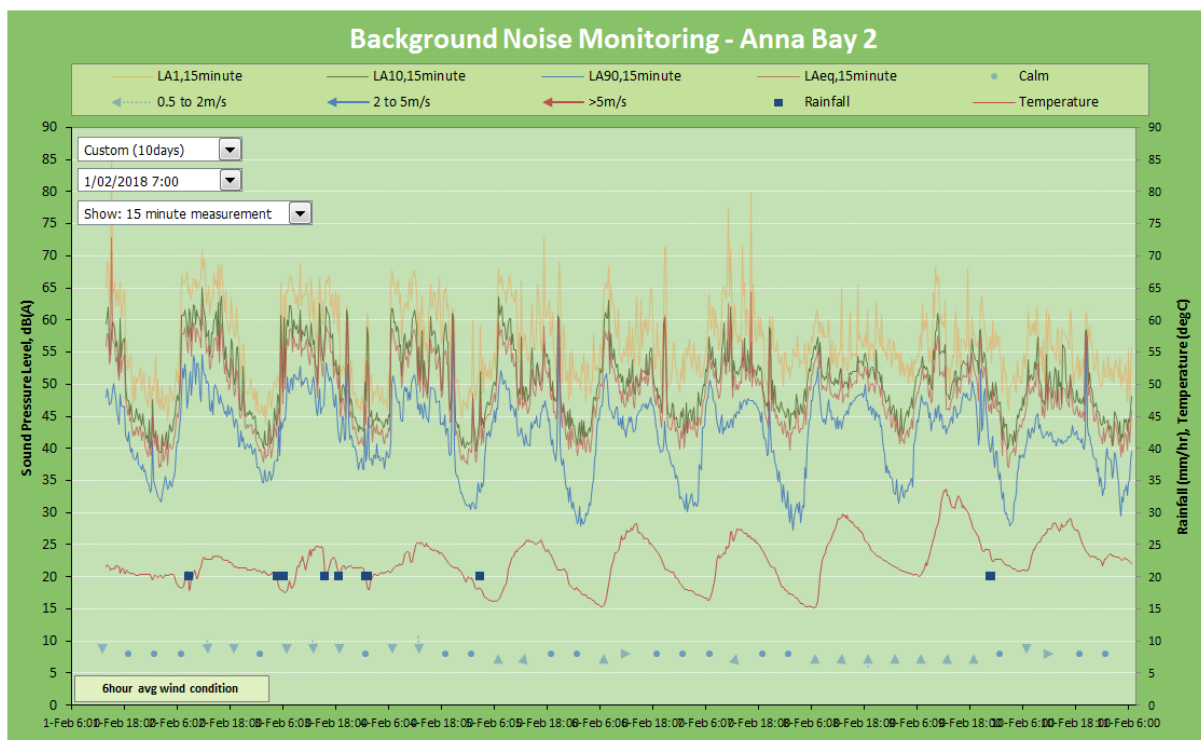


Figure I-2: Background noise monitoring at location Anna Bay 2, setback from Nelson Bay Road



Appendix II

Noise Level Contours



Figure II-1: Construction noise contours - Vegetation removal

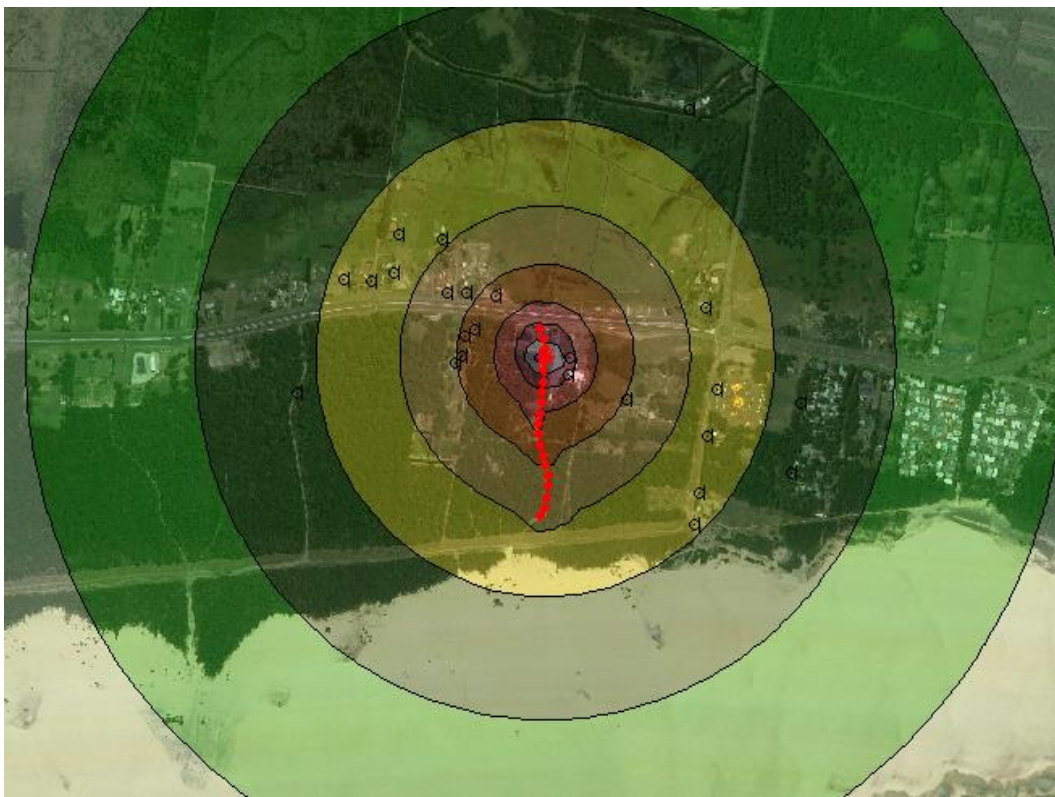


Figure II-2: Construction noise contours - Haul road widening



Figure II-3: Construction noise contours - Site preparation



Figure II-4: Construction noise contours - Concrete pouring

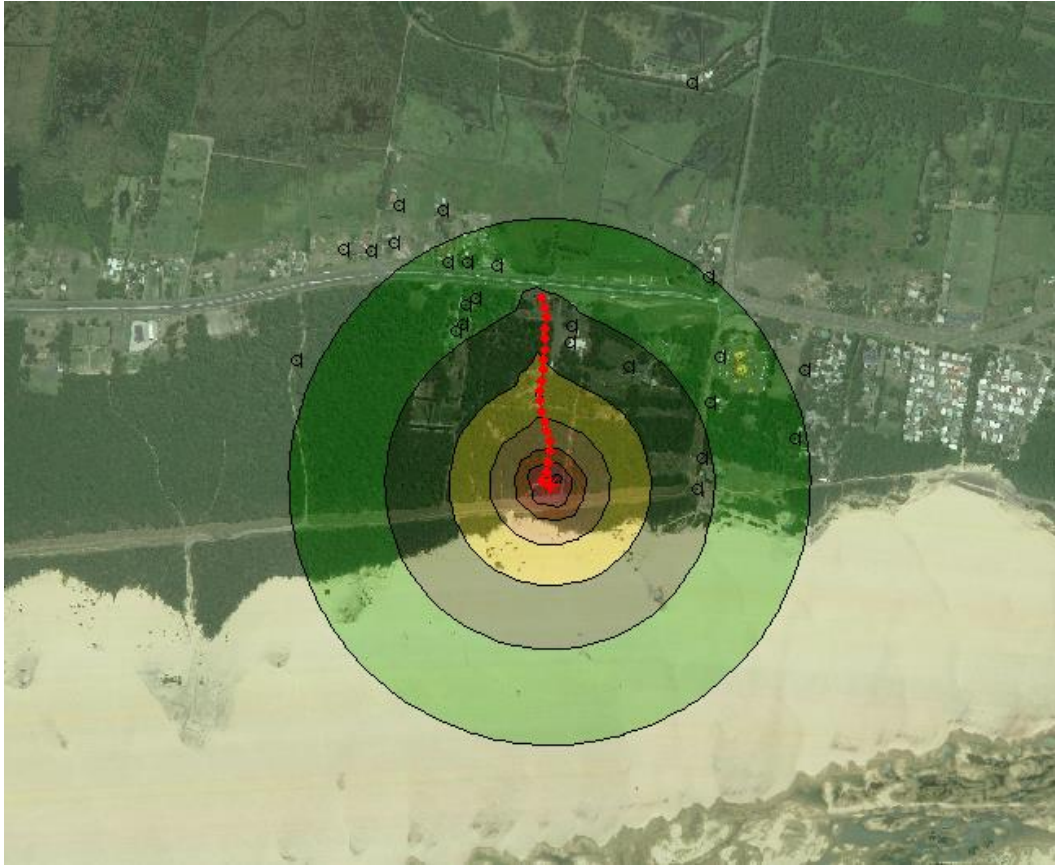


Figure II-5: Construction noise contours - Shed construction



Figure II-6: Construction noise contours - Formation widening



Figure II-7: Construction noise contours - Paving works

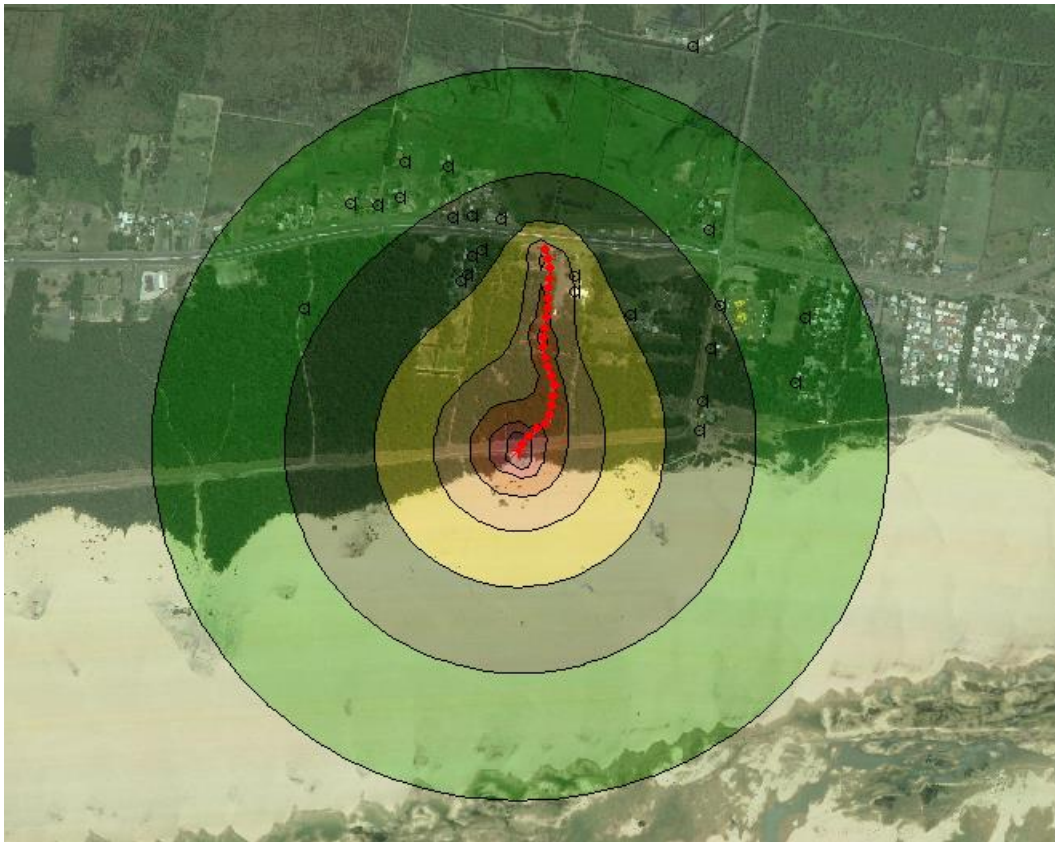


Figure II-8: Operation noise contours - Quarry operations



Figure II-9: Operation noise contours - Quarry operations including mulching

Appendix C: Air Quality Assessment



advitech

Report

Air Quality Impact Assessment

Anna Bay Sand Quarry

Hay Enterprises

8 March 2018

Rev 0 (Final)

Report Details

Air Quality Impact Assessment - Anna Bay Sand Quarry

Job #: J0170316, Folder #: F15339, Revision: 0 (Final), Date: 8 March 2018

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History

Date	Revision	Comments
6 March 2018	A	Draft Issue for Review
8 March 2018	0	Final Issue

Endorsements

Function	Signature	Name and Title	Date
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Checked and Authorised for Release by		Dr Carl Fung Lead Consultant - Process Engineering and Sustainability, CAQP (CASANZ)	8 March 2018

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Example CALPUFF Input File

1. INTRODUCTION

Advitech Pty Limited was engaged by Hay Enterprises to prepare an Air Quality Impact Assessment (AQIA) for the proposed development of the sand extraction quarry at Anna Bay. This assessment considers the air quality impacts of the proposed development on sensitive receivers adjacent to the site.

It should be noted that this report was prepared by Advitech Pty Limited for Hay Enterprises ('the customer') in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

2. BACKGROUND AND OBJECTIVES

2.1 Site Location and Surrounding Land Uses

Hay Enterprises proposes to extract sand from the southern end of 4226 Nelson Bay Road, Anna Bay (**Figure 1**). The sand quarry proposes to extract up to 50,000 cubic metres of sand per year.

The land is identified as Lot 591 DP 1191380. The site has an area of 13 hectares and is located approximately 30 kilometres north-east of Newcastle. The site is zoned RU2 Rural Landscape under the Port Stephens Local Environmental Plan, 2013. The surrounding area is zoned E1 National Parks and Nature Reserves and E3 Environmental Management.

The nearest potentially affected residences are shown on **Figure 3**. The residences are located in Anna Bay, along Nelson Bay Road and small rural streets. The area surrounding the development site can be described as an established rural setting and includes recreational facilities, sand quarries and rural residents.



Figure 1: Site Location

2.2 Project Description

The proposed sand extraction operations are as follows:

1. Sand will be extracted from the dunes on the southern side of the property by a front end loader as required. Extraction will initially clear the sand dune which has encroached on the power line easement.
2. Sand will be directly unloaded into incoming truck and dog trailer combinations for immediate delivery. Stockpiling or processing operations will not be undertaken on-site.
3. Sand extraction will continue on the sand dune south of the easement within the site boundary as sand continues to encroach the site.

The facility proposes to have capacity to operate on weekdays between 7 am - 6 pm and Saturdays between 8 am - 2 pm.

The process is such that aside from the sand no other material, including water will need to be removed from the site. Vegetation removed for the purposes of the caretaker's residence, site office, machinery shed construction and site access improvements will be mulched on site and redirected to areas around the site for soil improvement purposes. The site layout and indicative sand extraction area is presented in **Figure 2**.



Figure 2: Sand Quarry Layout

2.3 Sensitive Receivers

A number of potentially affected receivers were identified in the vicinity of the project site. These are shown in **Figure 3** and **Table 1**.

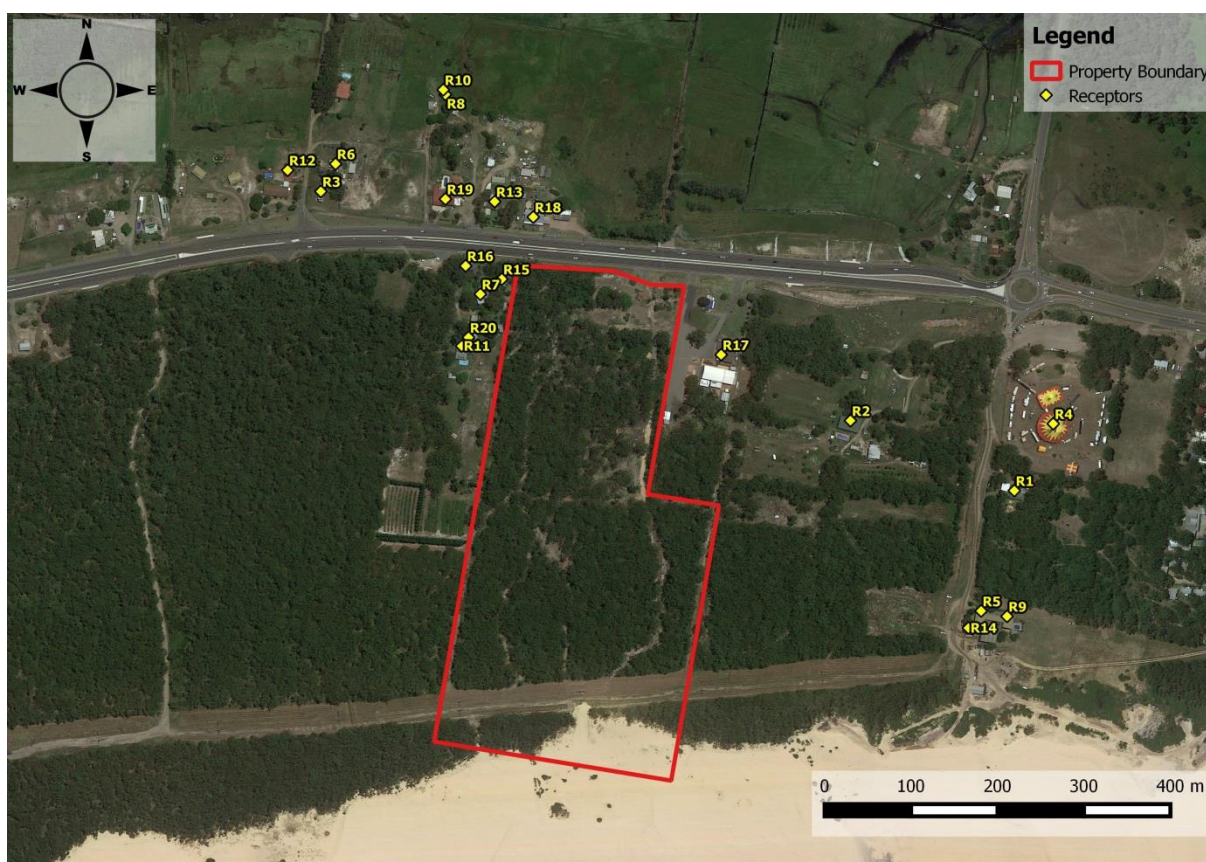


Figure 3: Sensitive Receivers

Table 1: Sensitive Receivers

Receiver ID	Easting (m)	Northing (m)	Address
R1	412483	6373710	6 Jessie Road, Anna Bay
R2	412293	6373789	5 Jessie Road, Anna Bay
R3	411678	6374047	4187 Nelson Bay Road, Anna Bay
R4	412528	6373787	2 Jessie Road, Anna Bay
R5	412446	6373571	Unit 2, 10 Jessie Road, Anna Bay
R6	411695	6374079	4199 Nelson Bay Road, Anna Bay
R7	411864	6373931	4208 Nelson Bay Road, Anna Bay
R8	411821	6374160	4199B Nelson Bay Road, Anna Bay
R9	412476	6373565	Unit 1, 10 Jessie Road, Anna Bay
R10	411819	6374165	4199A Nelson Bay Road, Anna Bay
R11	411843	6373871	Unit 2, 4206 Nelson Bay Road, Anna Bay
R12	411640	6374071	4181 Nelson Bay Road, Anna Bay

Receiver ID	Easting (m)	Northing (m)	Address
R13	411879	6374037	4205 Nelson Bay Road, Anna Bay
R14	412432	6373552	10 Jessie Road, Anna Bay
R15	411888	6373948	4210 Nelson Bay Road, Anna Bay
R16	411846	6373963	4206A Nelson Bay Road, Anna Bay
R17	412143	6373863	4236 Nelson Bay Road, Anna Bay
R18	411924	6374020	4213 Nelson Bay Road, Anna Bay
R19	411822	6374040	4201 Nelson Bay Road, Anna Bay
R20	411851	6373881	4206 Nelson Bay Road, Anna Bay

3. AIR QUALITY GUIDELINES

The NSW Environment Protection Authority (EPA) specify the impact assessment criteria in the publication *Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*, 2016. The relevant sections from this publication are reproduced below in **Table 2** which presents the ground level concentration (GLC) criteria for each applicable air pollutant.

Table 2: NSW EPA Impact Assessment Criteria

Pollutant	NSW EPA Design Criteria	Units	Averaging Time
TSP ^a	90	µg/m ³	Annual
PM ₁₀ ^b	50	µg/m ³	24 hours
	25	µg/m ³	Annual
PM _{2.5} ^c	25	µg/m ³	24 hours
	8	µg/m ³	Annual
Deposited Dust ^d	2 ^e	g/m ² /month	Annual
	4 ^f		

^a Total suspended particulates.

^b Particulate materials with an aerodynamic diameter less than 10 µm.

^c Particulate materials with an aerodynamic diameter less than 2.5 µm.

^d Dust is assessed as insoluble solids as defined by AS 3580.10.1.

^e Maximum increase in deposited dust level.

^f Maximum total deposited dust level.

4. METEOROLOGICAL DATA

To determine the most representative 12 month calendar period, required for modelling air emissions from the Anna Bay Sand Quarry, historical Bureau of Meteorology (BOM) climate data at the Williamstown Airport Automatic Weather Station (AWS) (061078) was reviewed in **Table 3**.

Table 3: Bureau of Meteorology (BoM) Climate Data History for Williamstown Airport (061078)

Year	Temperature (degrees Celsius)				Rainfall (mm)	
	Maximum year average	Difference from long term average	Minimum year average	Difference from long term average	Yearly total	Percentage of long term average
2008	22.8	- 0.3	12.1	- 0.3	1463.6	130%
2009	24.1	+1.0	12.6	+0.2	-	-
2010	23.8	+0.7	12.8	+0.4	956.2	85%
2011	23.7	+0.6	12.9	+0.5	1255.0	111%
2012	23.5	+0.4	12.2	- 0.2	988.8	88%
2013	24.5	+1.4	12.3	- 0.1	1299.8	115%
2014	24.1	+1.0	12.8	+0.4	868.0	77%
2015	23.9	+0.8	12.9	+0.5	1321.2	117%
2016	24.5	+1.4	13.4	+1.0	1147.1	102%

A review of BoM climate data suggests greater deviations in either the average rainfall or temperatures for the years 2008, 2009, 2013, 2014, 2015 and 2016. The years with the least deviation from long term average climate statistics are years 2010, 2011 and 2012.

The Williamstown locality has been the subject of previous proposed developments, most notably the Port Waratah Port Coal Services (PWCS) Terminal 4 Project. At present, the T4 Project has been recommended for approval by the NSW Department of Planning. The PWCS AQIA presented rigorous assessment of the local and regional climate and concluded that the year 2010 was the most representative year for modelling purposes. The PWCS AQIA quotes the following:

“Data from these monitoring stations (5 off) for 2010 was used to characterise the regional surface meteorology and provide input datasets for the meteorological modelling undertaken. Based on comparisons of the annual wind roses and statistical evaluation of the wind speed records for the previous five years, 2010 was concluded to be sufficiently representative of airflow patterns characteristic of each location.”

As a result of Advitech’s review of climatic data (refer to **Table 3**), previous PWCS T4 Project justifications and independent peer review, this study has adopted the 2010 year for air dispersion modelling purposes.

Meteorological data representative of the Anna Bay site was obtained from the following sources:

- BoM Nobby’s Head AWS data for 2010;
- BoM Williamstown Airport AWS data for 2010;
- Tomago Aluminium Company AWS data for 2010; and
- TRCMet 12 km resolution MM5 data for 2010.

4.1 CALMET

CALMET is a NSW EPA approved diagnostic meteorological model that produces three-dimensional wind fields based on parameterized treatments of terrain effects such as slope flows and terrain blocking effects. Meteorological observations are used to determine the wind field in areas of the domain within which the observations are representative.

CALMET was run in hybrid mode which combines the numerical prognostic model data in a 3D.DAT file (i.e. MM5 data from TRCMet) along with the surface observational data (i.e. Nobby's Head AWS, Williamtown Airport AWS and Tomago Aluminium Company AWS).

Figure 4 shows the frequency of wind speed and direction for each season during the 2010 calendar year extracted from the CALMET generated file.

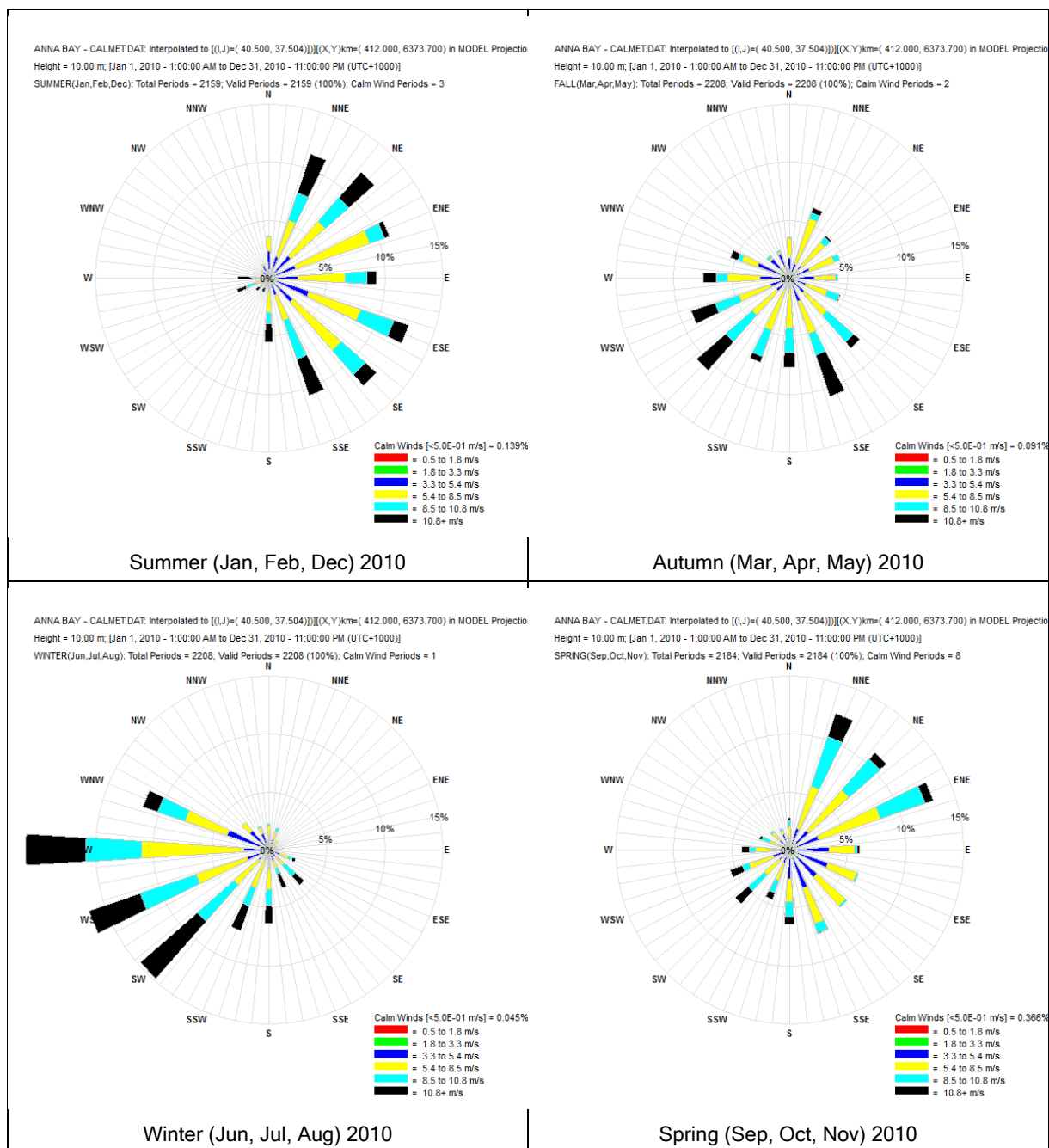


Figure 4: Seasonal Wind Roses, 2010

5. MODELLING APPROACH/METHODOLOGY

5.1 Background Air Quality

Assessment of background air quality data has been undertaken for the airshed in the vicinity of the proposed sand extraction operation.

The NSW Office of Environment and Heritage (OEH) operate an air quality monitoring program that collects accurate real-time measurements of ambient level pollutants at 28 monitoring sites within the air quality monitoring network (AQMN), located around the greater metropolitan area of Sydney, the Illawarra, the Lower Hunter and selected rural sites around NSW. The monitoring location that is considered to be representative of the Anna Bay area with data from the representative year is located at Beresfield approximately 20 kilometres to the west of the proposed development.

The Beresfield monitoring station commenced operation in 1998 and provides data on the following air quality parameters.

- Ozone;
- Particulates;
- NO, NO₂, NO_x; and
- SO₂.

A Level 1 assessment of background concentrations has been prepared for the pollutants listed in **Table 4** for the 2010 monitoring year to correspond with the meteorological data. The Level 1 assessment has assumed a worst-case background concentration by using the maximum reported value.

Table 4: Background Air Quality

Pollutant	Background Concentration ^a	Units	Averaging Time
TSP	33.2	µg/m ³	Annual
Dust Deposition	na	g/m ² /month	Annual
PM ₁₀	Variable (refer to Figure 4)	µg/m ³	24 Hours
	16.6	µg/m ³	Annual
PM _{2.5}	Variable (refer to Figure 4)	µg/m ³	24 Hours
	6.0	µg/m ³	Annual

^a Reported value is the average 24 hour result

^b Assumed from annual average PM₁₀ background (TSP = 2 x PM₁₀)

na - Not available

The maximum reported PM₁₀ and PM_{2.5} background concentration for the 2010 monitoring period was 50.0 and 25.9 µg/m³ respectively, which is above the NSW OEH impact assessment criteria. As such, a Level 2 or contemporaneous assessment of the PM₁₀ and PM_{2.5} background concentration is required to understand the cumulative impact of the proposed development.

Figure 5 displays the PM₁₀ and PM_{2.5} 24 hour average background concentrations for 2010 and indicates exceedances of the NSW OEH impact assessment criteria.

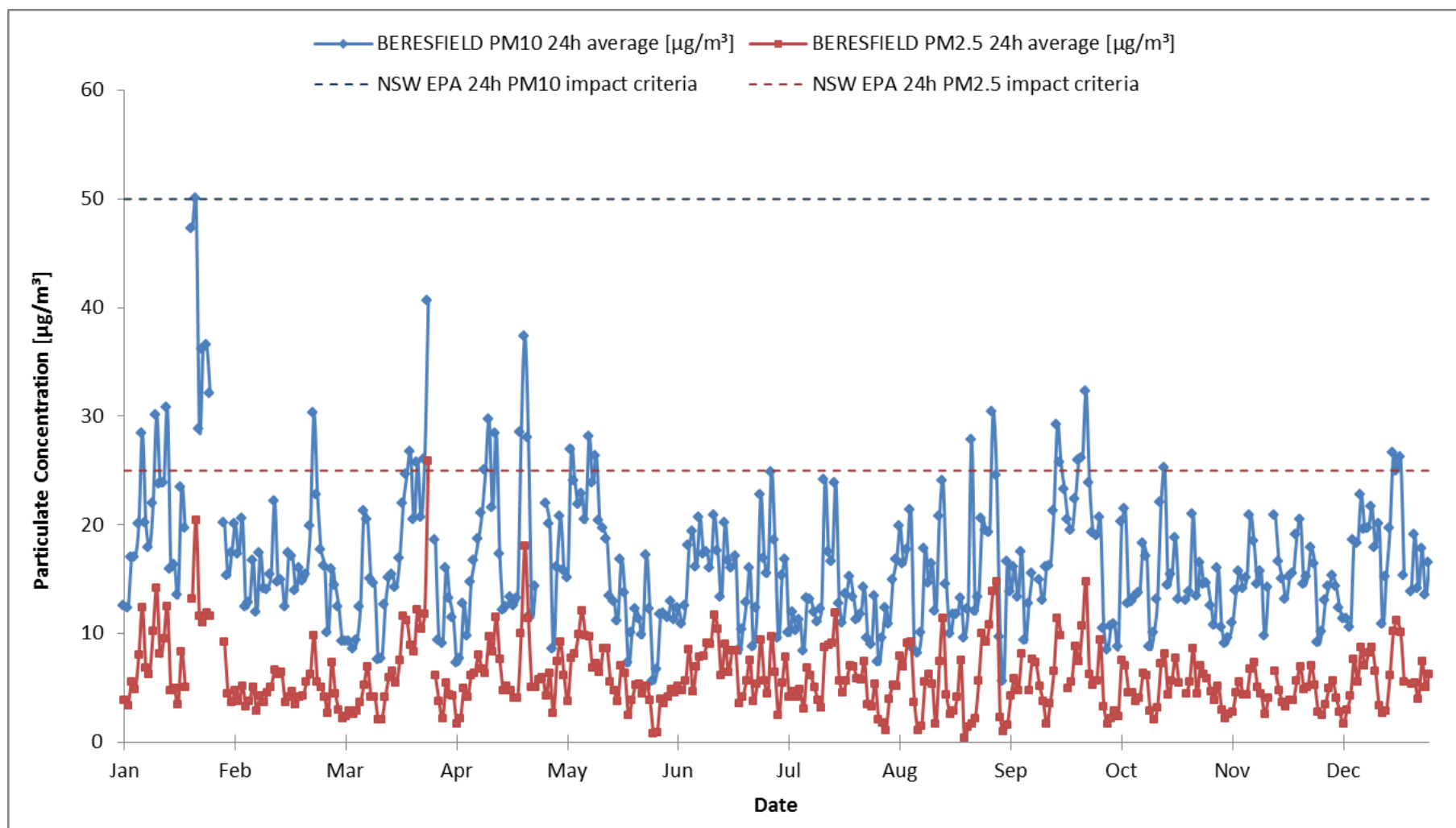


Figure 5: Daily Average Particulate Matter Concentrations for Beresfield 2010

5.2 Meteorological Model Configuration

Table 5 details the parameters used in the meteorological modelling to drive the CALMET model.

Table 5: CALMET Meteorological Parameters used in this Report

Identifier	Descriptor	Comment
MM5	Grid spacing	12 km × 12 km
	Year of analysis	2010
	Time step	hourly
CALMET (v 6.333)	Meteorological grid domain	10 km x 10 km
	Meteorological grid origin (SW corner)	408000 m, 6370000 m
	Meteorological grid resolution	0.1 km
	Surface meteorological station	Williamtown Airport AWS, Newcastle Nobbys AWS, Tomago Aluminium AWS
	TERRAD value	6 km
	Critical Parameters (R1, R2, R1Max, R2Max)	7 km, 7 km, 10 km, 10 km
	Cell Face Heights	0, 20, 40, 80, 160, 320, 700, 1300, 1700, 2300, 3000

5.3 Dispersion Modelling Configuration

CALPUFF is an advanced non-steady-state meteorological and air quality modelling system. The model advects ‘puffs’ of material emitted from modelled sources, simulating the dispersion and transformation processes along the way. The model has been adopted by the U.S. Environmental Protection Agency (U.S. EPA) in its guideline on air quality models. CALPUFF uses the 3D wind fields generated by CALMET with the primary output files from CALPUFF processed in CALPOST to produce time based concentration or deposition fluxes evaluated at selected receiver locations.

Particulate concentrations were simulated for a regular Cartesian receiver grid covering a 10 km by 10 km computational domain, set within the CALMET modelling domain and centred over the project area, with a grid resolution of 0.1 km. High resolution MM5 meteorological data for the year 2011 has been used in conjunction with locality specific meteorological data.

Section 5.5 outlines the assumptions made for the odour assessment. **Appendix I** contains example CALMET and CALPOST input files.

5.4 Modelling Scenarios

Sand extraction operations are to proceed as per the project description in **Section 2.2**. **Figure 6** below shows the sequence plan for the sand quarry operations. The sequence plan intends to control the inundation of sand onto the power line easement by continual removal from sand within the site boundary.

Dispersion modelling has been undertaken using the maximum hourly operational intensity as the emission basis for the entire 2010 calendar year, which is equivalent to approximately 260,000 cubic metres of sand per year. This assumption can be considered the worst case scenario and very conservative given the annual extraction limit of 50,000 cubic metres.

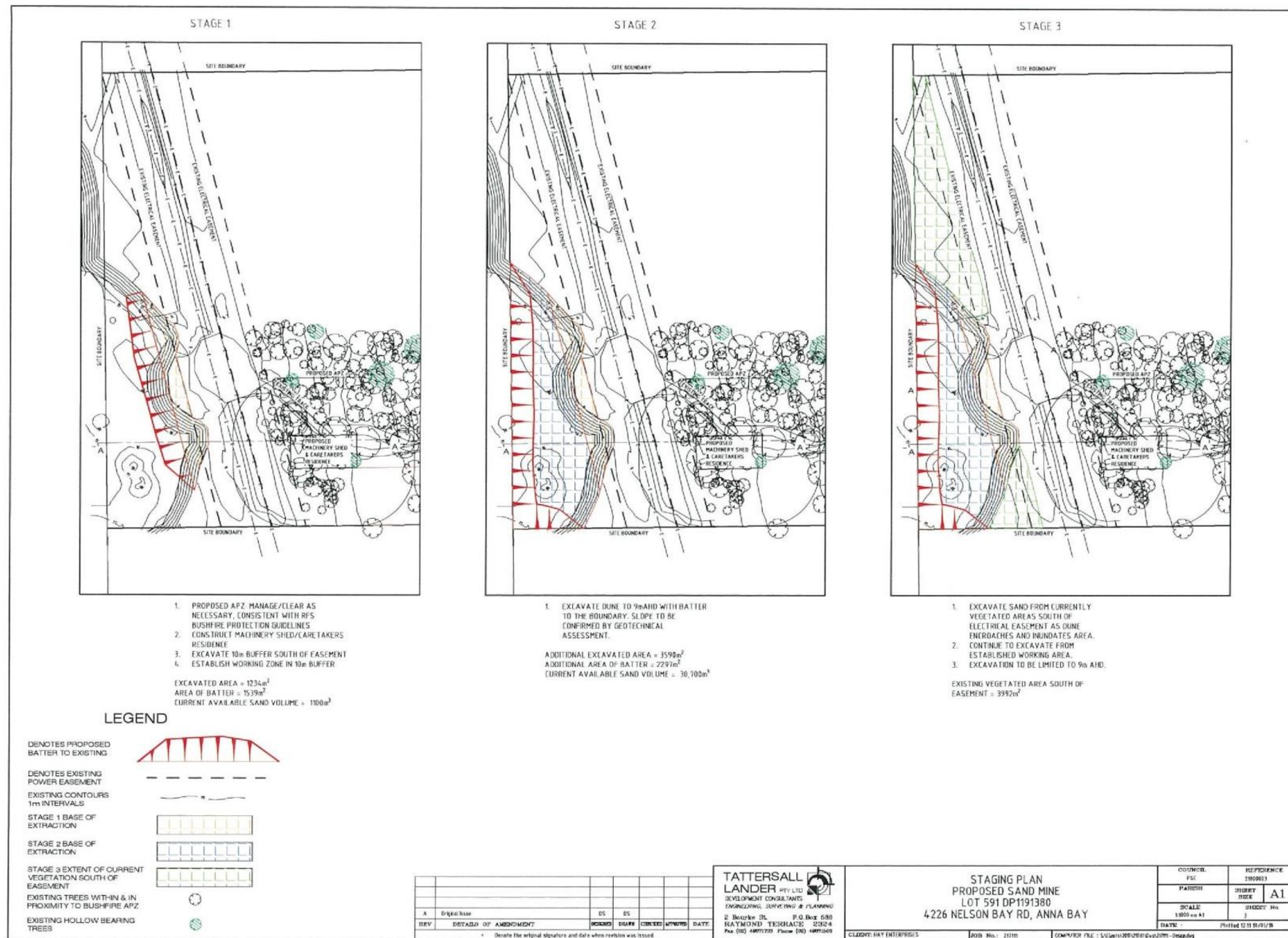


Figure 6: Proposed Sand Extraction Sequence Plan

5.5 Assumptions

Assumptions used in the computation of GLCs and deposition for particulates using the CALPUFF dispersion model are listed below:

- The topography surrounding the sand extraction quarry at Anna Bay is relatively flat. The minimum and maximum elevation within a 5 km radius of the subject site is 0 m and 60 m respectively. A digital terrain model of the site and surrounding topography is incorporated into the air dispersion model.
- Options within CALPUFF modelling reflect the *NSW OEH Generic Guidance and Optimum Model Settings for the CALPUFF Modelling System guidelines*.
- Wet deposition has not been applied to the CALPUFF model.
- Hourly weather data from the Williamtown Airport AWS, Nobbys Newcastle AWS and Tomago Aluminium AWS was used to generate the hybrid CALMET meteorological file between 1 January 2010 and 31 December.
- Moisture content for wheel generated dust emission factor estimation assumed to be 16 per cent for dense uniform sand (*Emission Estimation Technique Manual for Fugitive Emissions* 1999).
- Silt content for wheel generated dust emission factor estimation assumed to be 6 per cent for sand soils (Estimating soil particle size distribution and percent sand, silt and clay for six texture classes using the Australian Soil Resource Information System point database CSIRO 2001).
- Hay Enterprises sand quarry has been modelled based on a maximum extraction rate of 910 cubic metres (i.e. 1,400 tonnes) of sand per day. This assumes four truckloads of sand (i.e. 35 tonnes per load) will be removed per hour for 10 hours.
- Haul trucks which transfer sand from the sand quarry site have a capacity of 35 tonnes.
- The operating times for site quarry activities are as follows:
 - Monday to Friday: 7 am to 6 pm
 - Saturday 8 am to 2 pm
 - Sundays and Public Holidays: Closed
- The sand quarry extraction area is as per overall layout drawing provided by Tattersall Lander (refer to **Figure 6**).
- A PM_{2.5} to PM₁₀ ratio of 0.15 and 0.1 has been applied to sand handling and wheel generated emission sources respectively (*AP 42, Fifth Edition, Volume I, Chapter 13: Miscellaneous Sources*).
- The geometric mass mean diameters assumed in the modelling were 30 µm for TSP, 10 µm for PM₁₀ and 2.5 µm for PM_{2.5}. All pollutants were modelled with 0 µm geometric standard deviation.
- Wheel generated dust from haul trucks within the sand quarry extraction area was modelled as a volume source in CALPUFF. Each volume source has a separation distance of less than one quarter of the distance to the nearest residential receiver. Particulate emissions were equally divided between volume sources.
- The number of vehicle kilometres travelled is calculated on the unpaved haul route separating the sand extraction area and the intersection at Nelson Bay road.

5.6 Emission Sources

The activities associated with the proposed operations with the potential to generate dust are:

- Operation of front-end loaders within the extraction area;
- Loading by front-end loaders to the haul trucks; and
- Dust generated by haul truck movements within the excavation area.

Details of each emission source are given in **Table 6**. The emission factors and estimates are based on Emission Estimation Technique (EET) Manual for Mining - Version 3.1. Emissions from the manual are based on typical emission for coal and metalliferous mining operations. The emission factors have been applied to the sand quarry operation and can be considered as a conservative estimate.

Table 6: Modelled Emission Sources

Emitter Identifier	Emitter Name	Emission Factor			Modelled days (Days)	Modelled Working hours (hours/day)	Emission Rate(g/s)			Modelled Location		
		TSP	PM ₁₀	Units			TSP	PM ₁₀	PM _{2.5}	Easting (m)	Northing (m)	Ground Elevation (m)
FEL	Front end loader	0.00015	0.000071	kg/t	365	10	0.00586	0.00277	0.00042	411981	6373452	10
Load	Loading of sand into haul trucks	0.00015	0.000071	kg/t	365	10	0.00586	0.00277	0.00042	412017	6373495	11
HR1-HR21	Wheel generated dust from truck movements ¹	2.2430	0.598	kg/VKT	365	10	0.121	0.032	0.0032	Varies	Varies	Varies

Notes:

1 - Kilometres travelled by haul trucks estimated from Google Earth satellite imagery and allowing for four loads per hour. Wheel generated dust from haul trucks within the sand quarry site were modelled as a volume source in CALPUFF. Each volume source has a separation distance of 25 metres.

6. DISPERSION MODELLING RESULTS

6.1 Annual Average PM₁₀, PM_{2.5}, TSP

The predicted concentrations of the annual average PM₁₀, PM_{2.5} and TSP for the proposed operation are presented in **Table 7**. The contour plots are presented in **Appendix I**.

Table 7: Predicted Annual Average PM₁₀, PM_{2.5} and TSP at Sensitive Receivers

Receiver	Predicted Annual Average PM ₁₀ Increment +Background (µg/m ³)	Predicted Annual Average PM _{2.5} Increment +Background (µg/m ³)	Predicted Annual Average TSP Increment +Background (µg/m ³)
Background	16.6	6.0	33.2
R1	16.8	6.0	33.9
R2	17.1	6.1	34.8
R3	16.9	6.0	34.0
R4	16.7	6.0	33.6
R5	16.9	6.1	34.2
R6	16.9	6.0	34.0
R7	17.4	6.1	35.7
R8	16.9	6.0	34.2
R9	16.9	6.0	34.0
R10	16.9	6.0	34.1
R11	17.7	6.2	36.7
R12	16.8	6.0	33.9
R13	17.2	6.1	35.0
R14	16.9	6.1	34.2
R15	17.4	6.1	35.8
R16	17.2	6.1	35.0
R17	18.4	6.2	39.4
R18	17.3	6.1	35.7
R19	17.0	6.1	34.5
R20	17.7	6.2	36.7
Impact Criteria	25	8	90

Table 7 presents the predicted cumulative 100th percentile annual average PM₁₀, PM_{2.5} and TSP for sensitive receivers respectively. An annual average background PM₁₀, PM_{2.5} and TSP concentration has been applied (refer to **Table 4**) to determine if further assessment is required.

The annual PM₁₀, PM_{2.5} and TSP impact assessment criteria are not exceeded at any sensitive receivers. According to the NSW OEH guidance, no additional contemporaneous assessment of annual average PM₁₀, PM_{2.5} and TSP is required.

6.2 24 Hour Average PM₁₀

The predicted concentrations of the 24-hour average PM₁₀ maximum increment for the proposed operation are presented in **Figure 7**.

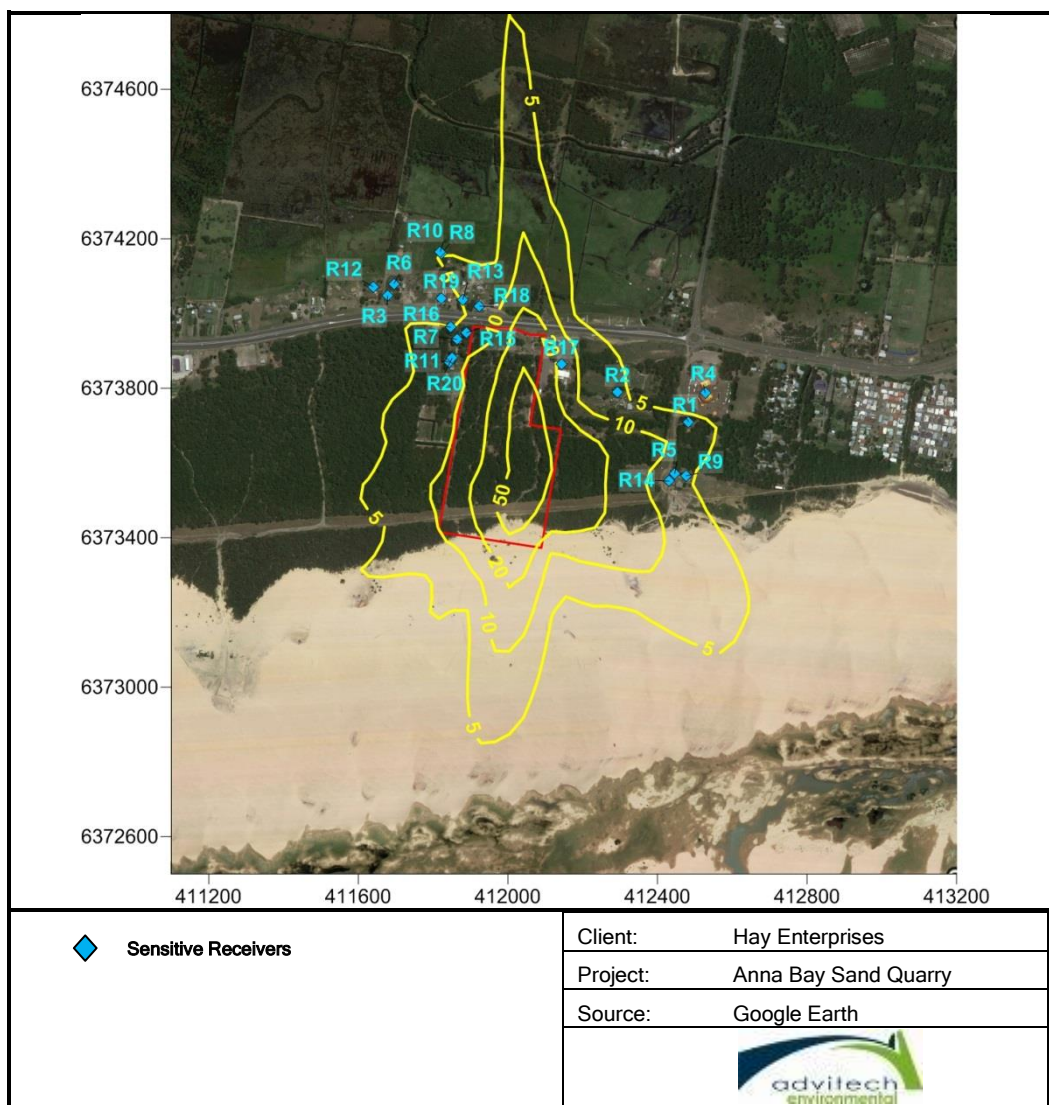


Figure 7: 100th Percentile 24 Hour Average PM₁₀ Concentration
(Contour labels = 5, 10, 20, 50 µg/m³)

The predicted concentrations of the 24 hour average PM₁₀ impact for the proposed operation are presented in **Table 8**.

Table 8: Maximum Impact of 24 Hour Average PM₁₀

Receiver	Maximum Predicted Increment (µg/m ³)	Maximum Background Concentration	Total (µg/m ³)	Impact Assessment Criteria
R1	6.1	47.2 µg/m ³ (20/1/2010)	53.3	50 µg/m ³
R2	5.5		52.7	
R3	4.3		51.5	
R4	3.0		50.2	
R5	5.8		53.0	
R6	3.6		50.8	
R7	6.4		53.6	
R8	5.2		52.4	
R9	5.0		52.2	
R10	5.1		52.3	
R11	8.7		55.9	
R12	4.0		51.2	
R13	5.2		52.4	
R14	6.3		53.5	
R15	5.5		52.7	
R16	4.9		52.1	
R17	14.6		61.8	
R18	7.0		54.2	
R19	3.7		50.9	
R20	9.3		56.5	

¹ The background concentration of 50.0 µg/m³ (refer to **Figure 5**) has been discounted as it is above the impact assessment criteria. Therefore the next highest value of 47.2 µg/m³ was used.

The exceedances at nearby sensitive receivers of the 24 hour average PM₁₀ concentration presented in **Table 8** are a result of an elevated background PM₁₀ concentration. A Level 2 contemporaneous impact and background assessment is required to determine any additional exceedances as a result of the proposed operation.

A summary of the 24 hour average PM₁₀ contemporaneous impact and background assessment (Level 2 Assessment) for identified sensitive receivers are presented in **Table 9**.

Table 9: Summary of the 24 Hour Average PM₁₀ Contemporaneous Impact and Background

Date	PM ₁₀ 24-hour average (µg/m ³)				Date	PM ₁₀ 24-hour average (µg/m ³)			
	Highest Background	Predicted Increment	Receiver	Total		Background	Highest Predicted Increment	Receiver	Total
21/01/2010	50.0¹	1.7	R11	51.7¹	16/06/2010	17.6	14.6	R17	32.2
20/01/2010	47.2	2.5	R20	49.7	5/07/2010	16.8	13.6	R17	30.4
27/03/2010	40.6	2.5	R17	43.1	24/09/2010	22.3	13.4	R17	35.7
23/04/2010	37.3	2.9	R18	40.2	20/05/2010	16.8	13.2	R17	30.0
24/01/2010	36.5	0.0 ²	R1	36.5	10/08/2010	8.5	9.3	R20	17.8
23/01/2010	36.1	1.6	R20	37.7	28/04/2010	0.0	8.8	R17	8.8
27/09/2010	32.2	2.9	R17	35.1	1/07/2010	24.8	8.6	R17	33.4
25/01/2010	32.0	4.9	R20	36.9	30/07/2010	13.4	7.9	R17	21.3
13/01/2010	30.7	0.8	R11	31.5	12/07/2010	13.1	7.5	R17	20.6
1/09/2010	30.3	2.8	R17	33.1	17/08/2010	20.7	7.2	R17	27.9
23/02/2010	30.2	1.2	R18	31.4	6/04/2010	12.7	7.1	R17	19.8
10/01/2010	30.0	0.0 ²	R1	30.0	15/09/2010	13.0	6.6	R17	19.6

¹ Predicted exceedance discounted as 24 hour average PM₁₀ was already at the NSW OEH impact criteria.

² No predicted 24 hour average PM₁₀ recorded at any sensitive receiver.

The exceedance displayed in **Table 9** has been discounted due to a background concentration greater than the impact assessment criteria. There are no additional exceedances of the 24 hour PM₁₀ impact assessment criteria at nearby sensitive receivers. According to the NSW OEH guidance, mitigation measures or emission controls that reduce emissions are not required.

6.3 24 Hour Average PM_{2.5}

The predicted concentrations of the 24 hour average PM_{2.5} for the proposed operation are presented in **Figure 8** and **Table 10**.

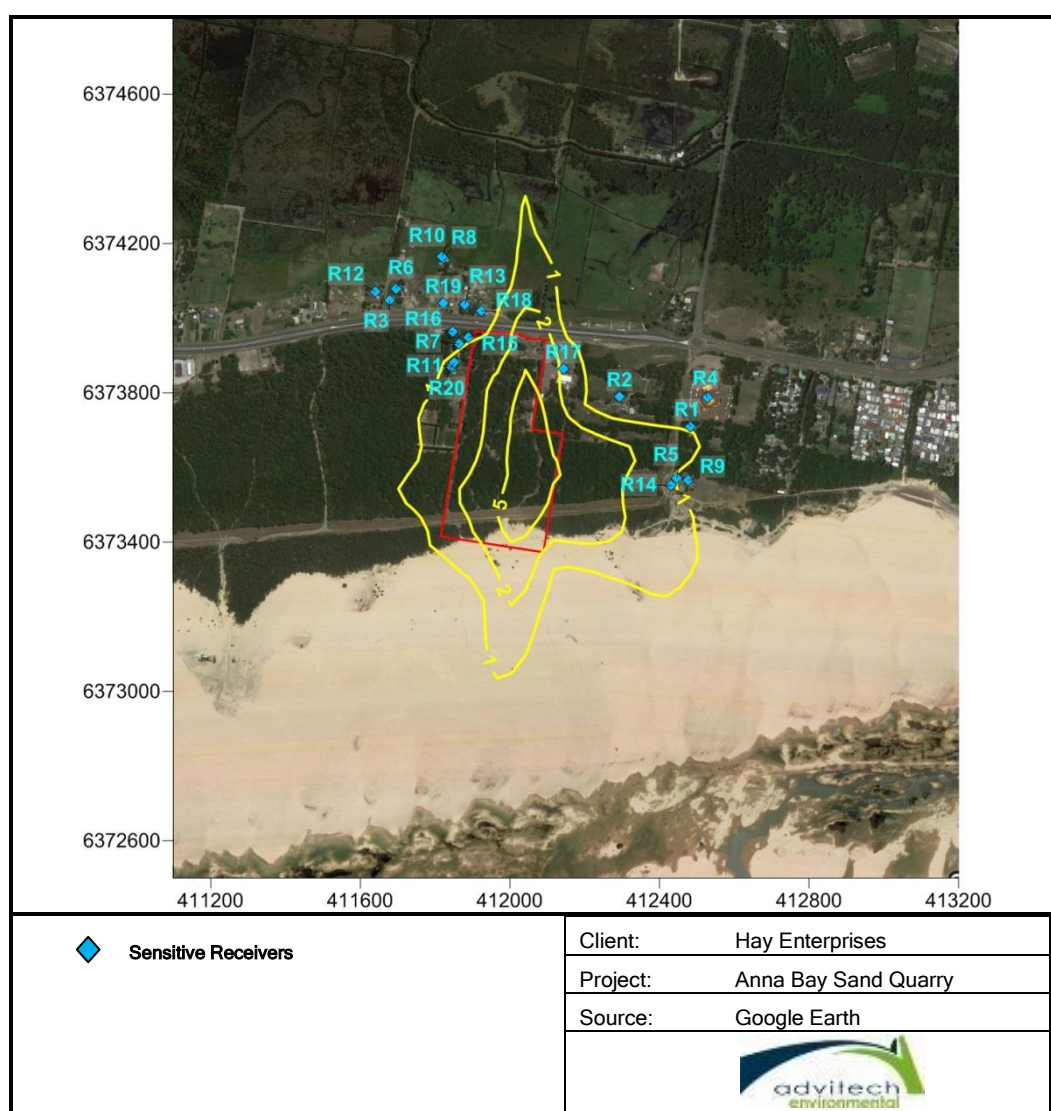


Figure 8: 100th Percentile 24 Hour Average PM_{2.5} Concentration
(Contour labels = 1, 2, 5 µg/m³)

Table 10 presents the predicted cumulative 100th percentile 24 hour average PM_{2.5} for sensitive receivers respectively. A maximum 24 hour PM_{2.5} background concentration of 20.4 µg/m³ has been applied (refer to **Table 4**) to determine if further assessment is required.

Table 10: Predicted Maximum 24 Hour Average PM_{2.5} at Sensitive Receivers

Receiver	Predicted Increment (µg/m ³)	Background Concentration ¹	Total (µg/m ³)	Impact Assessment Criteria
R1	0.9	20.4 µg/m ³	21.3	25 µg/m ³
R2	0.6		21.0	
R3	0.5		20.9	
R4	0.4		20.8	
R5	0.9		21.3	
R6	0.5		20.9	
R7	0.9		21.3	
R8	0.6		21.0	
R9	0.8		21.2	
R10	0.6		21.0	
R11	1.1		21.5	
R12	0.5		20.9	
R13	0.7		21.1	
R14	1.0		21.4	
R15	0.9		21.3	
R16	0.7		21.1	
R17	1.5		21.9	
R18	0.8		21.2	
R19	0.6		21.0	
R20	1.1		21.5	

¹ The background concentration of 25.9 µg/m³ (refer to **Figure 5**) has been discounted as it is above the impact assessment criteria. Therefore the next highest value of 20.4 µg/m³ was used.

The 24 hour average PM_{2.5} impact assessment criteria are not exceeded at any sensitive receivers. According to the NSW OEH guidance, no additional contemporaneous assessment of 24 hour average PM_{2.5} is required.

6.4 Dust Deposition

The predicted annual average dust deposition rates for the proposed operation are presented in Table 11.

Table 11: Predicted Dust Deposition at Sensitive Receivers

Receiver	Predicted Increment (g/m ² /month)	Impact Assessment Criteria
R1	0.3	2 g/m ² /month
R2	0.8	
R3	0.3	
R4	0.2	
R5	0.5	
R6	0.3	
R7	1.2	
R8	0.3	
R9	0.4	
R10	0.2	
R11	1.5	
R12	0.2	
R13	0.7	
R14	0.5	
R15	1.2	
R16	0.8	
R17	3.4	
R18	1.1	
R19	0.5	
R20	1.5	

The maximum incremental deposited dust level predicted at a sensitive receiver is 3.4 g/m²/month at Receptor 17. This modelling is based on the proposed maximum daily intensity of the sand extraction continuously operating at maximum intensity for the entire year (i.e. 910 cubic metres per day approximately equating to 260,000 cubic metres of sand extracted per year). However the sand extraction operations will likely fluctuate with customer demand and extraction will be limited to a maximum of 50,000 cubic metres per year. The impact is not likely to exceed the maximum increase in deposited dust level criteria of 2 g/m²/month during normal operations.

6.5 Discussion

The particulate dispersion modelling indicates that air quality impacts (i.e. airborne dust and dust deposition) from the sand quarry will be low and there will not be additional exceedances of the PM₁₀, PM_{2.5} and TSP impact assessment criteria at sensitive receivers. Any exceedances that may occur will be likely attributed to elevated background concentrations rather than emissions from the sand quarry.

The maximum increase in dust deposition impact assessment criteria of 2 g/m²/month is predicted to be exceeded at one sensitive receiver (i.e. R17). However the modelling scenario is considered to be very conservative and normal operations are unlikely to exceed the impact assessment criteria.

6.5.1 Construction Works

Potential air quality impacts may be generated from the construction of the machinery shed/caretakers residence/ site office, intersection upgrade and haul route realignment. The construction works and all related activities are expected to be completed within a 1 - 2 month period. The intensity of the activities will be highly varied depending on the schedule of construction.

It is expected the short term construction will be managed in accordance with *NSW OEH Air Quality Guidance Note for Construction Sites*. Air quality impacts from the proposed construction activities are likely to be low due to the short term construction duration, the buffer distance to sensitive receptors and the dense vegetation surrounding the site.

7. CONCLUSIONS

Advitech modelled a worst-case scenario (i.e. 910 cubic metres per day approximately equating to 260,000 cubic metres of sand extracted per year) for the proposed Anna Bay sand quarry to assess the potential particulate impacts to sensitive receivers. The results of the CALPUFF modelling indicate that operation (50,000 cubic metres of sand per year) of the sand extraction quarry will result in incremental increases in particulate matter and dust deposition at surrounding sensitive receivers.

CALPUFF dispersion modelling indicates that the Anna Bay Quarry operations will be below the NSW EPA impact assessment criteria for TSP, PM₁₀ and PM_{2.5} as a result of cumulative impacts. Any exceedances that may occur will be likely attributed to elevated background concentrations rather than a significant incremental contribution from the proposed development.

The maximum increase in dust deposition impact assessment criteria of 2 g/m²/month is predicted to be exceeded at Receiver 17. However the modelling scenario is considered to be very conservative is not likely to exceed the maximum increase in deposited dust level criteria of 2 g/m²/month during normal operations.

8. REFERENCES

The following information was used in the preparation of this report:

1. Bureau of Meteorology Climate Statistics accessed via <http://www.bom.gov.au/climate/data/> on 22 May, 2017.
2. Department of Sustainability, Environment, Water, Population and Communities, 1999. *Emission Estimation Technique (EET) Manual for Fugitive Emissions - Version 1.0.*
3. Department of Sustainability, Environment, Water, Population and Communities, 2012. *Emission Estimation Technique (EET) Manual for Mining - Version 3.1.*
4. ENVIRON Australia, 2012. *Air Quality Assessment for the Terminal 4 Project.*
5. Midwest Research Institute, 2006. *Background Document for Revisions to Fine Fraction Ratios Used for AP-42 Fugitive Dust Emission Factors*
6. NSW EPA, 2016. *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.*
7. NSW OEH, 2011. *Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'*
8. NSW OEH, *Air Quality Guidance Note for Construction Sites.*
9. NSW OEH, Air Quality Monitoring Network accessed via <http://www.environment.nsw.gov.au/AQMS/> on 22 May, 2017.
10. Scire, J., 2011 supplied information and personal communications.
11. Scire, J., and Barclay, J., 2011. *CALPUFF Training Course - April 4-6, 2011, Melbourne.*
12. Tattersall Lander supplied information, drawings and plans.
13. United States Environmental Protection Agency. *AP 42, Chapter 13: Miscellaneous Sources*, Volume 1, Fifth Edition.



Appendix I

Contour Plots

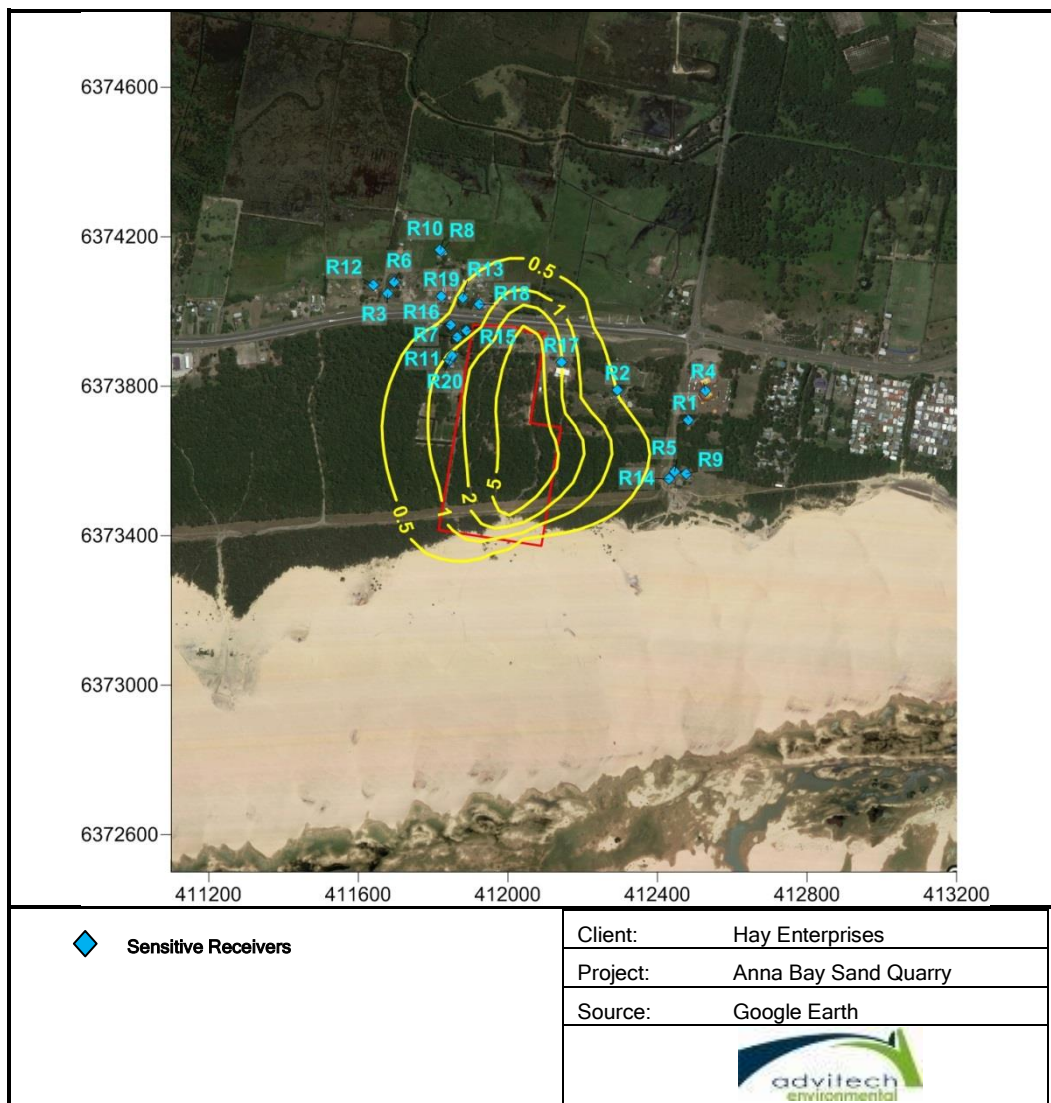


Figure 9: 100th Percentile Annual Average PM₁₀ Concentration
(Contour labels = 0.5, 1, 2, 5 µg/m³)

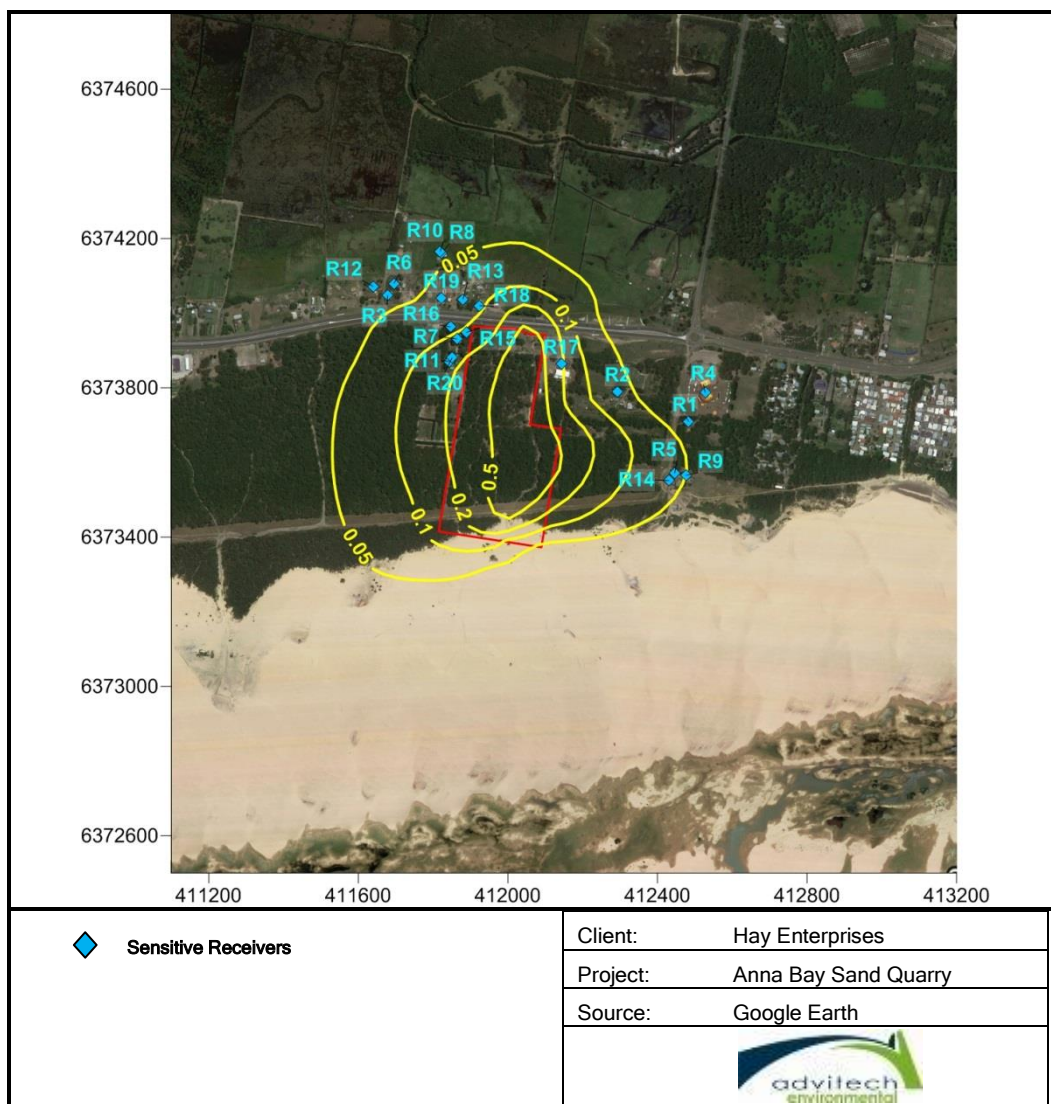


Figure 10: 100th Percentile Annual Average PM_{2.5} Concentration
 (Contour labels = 0.05, 0.1, 0.2, 0.5 µg/m³)

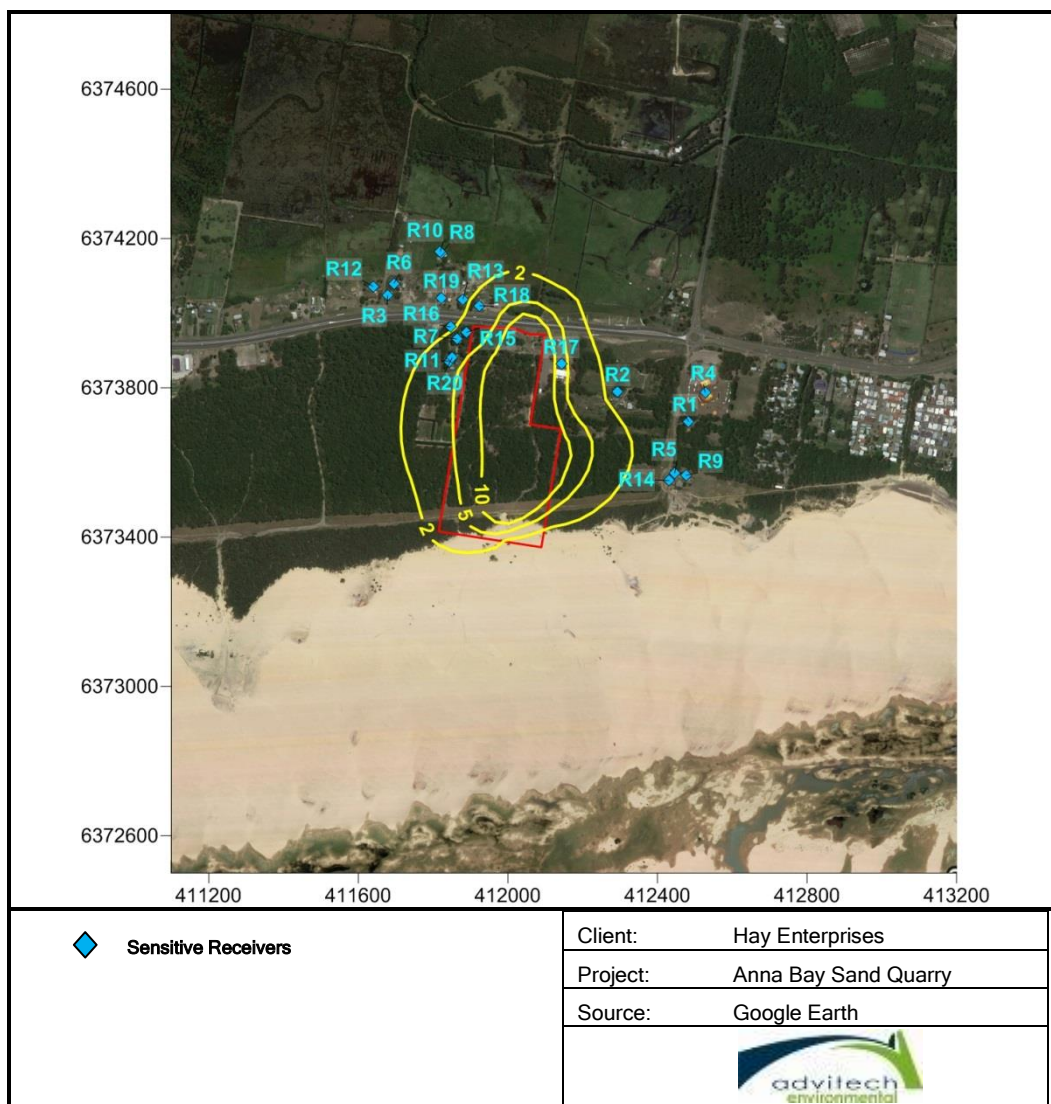


Figure 11: 100th Percentile Annual Average TSP Concentration
(Contour labels = 2, 5, 10 µg/m³)



Appendix II

Example CALPUFF Input File

Anna_Bay_Quarry_calmet.inp
CALMET.INP 2.1 Hour Start and End Times with Seconds
Anna Bay Quarry
HYBRID
1/01/2010 00:00 - 1/01/2011 00:00
----- Run title (3 lines) -----

CALMET MODEL CONTROL FILE

INPUT GROUP: 0 -- Input and Output File Names

Subgroup (a)

Default Name	Type	File Name
GEO.DAT	input	! GEODAT = F:\15339 TL Anna Bay Sand Quarry\Env\2_Analysis\Output Data\AQ\Preprocessing\anna_bay_quarry_geo.dat !
SURF.DAT	input	! SRFDAT = F:\15339 TL Anna Bay Sand Quarry\Env\2_Analysis\Output Data\AQ\CALMET\surf.dat !
CLOUD.DAT	input	* CLDDAT= *
PRECIP.DAT	input	! PRCDAT = !
WT.DAT	input	* WTDAT= *
CALMET.LST	output	! METLST = Anna_Bay_Quarry_calmet.lst !
CALMET.DAT	output	! METDAT = Anna_Bay_Quarry_calmet.dat !
PACOUT.DAT	output	* PACDAT= *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
T = lower case ! LCFILES = T !
F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

Number of upper air stations (NUSTA) No default ! NUSTA = 0 !
Number of overwater met stations (NOWSTA) No default ! NOWSTA = 0 !

NUMBER OF PROGNOSTIC and IGF-CALMET FILES:

Number of MM4/MM5/3D.DAT files (NM3D) No default ! NM3D = 1 !
Number of IGF-CALMET.DAT files (NIGF) No default ! NIGF = 0 !

!END!

Subgroup (b)

Upper air files (one per station)

Default Name	Type	File Name

Subgroup (c)

Overwater station files (one per station)

Default Name	Type	File Name

Subgroup (d)

MM4/MM5/3D.DAT files (consecutive or overlapping)

Anna_Bay_Quarry_calmet.inp

Default Name	Type	File Name
MM51.DAT	input	1 ! M3DDAT= Z:\1 ENVIRONMENT\1 Subject Areas\MetData\MM5\Yr2010\Tile 360\Tile0360yr.m3d ! !END!

Subgroup (e)

IGF-CALMET.DAT files (consecutive or overlapping)

Default Name	Type	File Name
IGFn.DAT	input	1 * IGFDAT=CALMET0.DAT * *END*

Subgroup (f)

Other file names

Default Name	Type	File Name
DIAG.DAT	input	* DIADAT= *
PROG.DAT	input	* PRGDAT= *
TEST.PRT	output	* TSTPRT= *
TEST.OUT	output	* TSTOUT= *
TEST.KIN	output	* TSTKIN= *
TEST.FRD	output	* TSTFRD= *
TEST.SLP	output	* TSTSLP= *
DCST.GRD	output	* DCSTGD= *

NOTES: (1) File/path names can be up to 70 characters in length
 (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by delimiters) at the end of the group
 (3) Subgroups (b) through (e) are included ONLY if the corresponding number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and each must have an 'END' (surround by delimiters) at the end of EACH LINE
 !END!

INPUT GROUP: 1 -- General run control parameters

Starting date:	Year (IBYR) -- No default ! IBYR = 2010 !
	Month (IBMO) -- No default ! IBMO = 1 !
	Day (IBDY) -- No default ! IBDY = 1 !
Starting time:	Hour (IBHR) -- No default ! IBHR = 0 !
	Second (IBSEC) -- No default ! IBSEC = 0 !
Ending date:	Year (IEYR) -- No default ! IEYR = 2011 !
	Month (IEMO) -- No default ! IEMO = 1 !
	Day (IEDY) -- No default ! IEDY = 1 !
Ending time:	Hour (IEHR) -- No default ! IEHR = 0 !
	Second (IESEC) -- No default ! IESEC = 0 !
UTC time zone (character*8)	(ABTZ) -- No default ! ABTZ = UTC+1000 !
PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000	
CST = UTC-0600, EST = UTC-0500	

Length of modeling time-step (seconds)
 Must divide evenly into 3600 (1 hour)
 (NSECDT) Default:3600 ! NSECDT = 3600 !

Anna_Bay_Quarry_calmet.inp
Units: seconds

Run type (IRTYPE) -- Default: 1 ! IRTYPE= 1 !

0 = Computes wind fields only
1 = Computes wind fields and micrometeorological variables
(u*, w*, L, zi, etc.)
(IRTYPE must be 1 to run CALPUFF or CALGRID)

Compute special data fields required
by CALGRID (i.e., 3-D fields of W wind
components and temperature)
in addition to regular Default: T ! LCALGRD = T !
fields ? (LCALGRD)
(LCALGRD must be T to run CALGRID)

Flag to stop run after
SETUP phase (ITEST) Default: 2 ! ITEST= 2 !
(Used to allow checking
of the model inputs, files, etc.)
ITEST = 1 - STOPS program after SETUP phase
ITEST = 2 - Continues with execution of
COMPUTATIONAL phase after SETUP

Test options specified to see if
they conform to regulatory
values? (MREG) No Default ! MREG = 0 !

0 = NO checks are made
1 = Technical options must conform to USEPA guidance

IMIXH	-1	Maul-Carson convective mixing height over land; OCD mixing height overwater
ICOARE	0	OCD deltaT method for overwater fluxes
THRESHL	0.0	Threshold buoyancy flux over land needed to sustain convective mixing height growth
ISURFT	> 0 -2	Pick one representative station, OR in NOOBS mode (ITPROG=2) average all surface prognostic temperatures to get a single representative surface temp.
IUPT	> 0 -2	Pick one representative station, OR in NOOBS mode (ITPROG>0) average all surface prognostic temperatures to get a single representative surface temp.
IZICRLX	0	Do NOT use convective mixing height relaxation to equilibrium value

!END!

INPUT GROUP: 2 -- Map Projection and Grid control parameters

Projection for all (X,Y):

Map projection
(PMAP) Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator
TTM : Tangential Transverse Mercator
LCC : Lambert Conformal Conic
PS : Polar Stereographic
EM : Equatorial Mercator
LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin

Anna_Bay_Quarry_calmet.inp

(Used only if PMAP= TTM, LCC, or LAZA)
 (FEAST) Default=0.0 ! FEAST = 0.000 !
 (FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)
 (Used only if PMAP=UTM)
 (IUTMZN) No Default ! IUTMZN = 56 !

Hemisphere for UTM projection?
 (Used only if PMAP=UTM)
 (UTMHEM) Default: N ! UTMHEM = S !
 N : Northern hemisphere projection
 S : Southern hemisphere projection

Latitude and Longitude (decimal degrees) of projection origin
 (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
 (RLAT0) No Default ! RLAT0 = 40N !
 (RLON0) No Default ! RLON0 = 90W !

TTM : RLON0 identifies central (true N/S) meridian of projection
 RLAT0 selected for convenience
 LCC : RLON0 identifies central (true N/S) meridian of projection
 RLAT0 selected for convenience
 PS : RLON0 identifies central (grid N/S) meridian of projection
 RLAT0 selected for convenience
 EM : RLON0 identifies central meridian of projection
 RLAT0 is REPLACED by 0.0N (Equator)
 LAZA: RLON0 identifies longitude of tangent-point of mapping plane
 RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection
 (Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 30N !
 (XLAT2) No Default ! XLAT2 = 60N !

LCC : Projection cone slices through Earth's surface at XLAT1 and
 XLAT2
 PS : Projection plane slices through Earth at XLAT1
 (XLAT2 is not used)

 Note: Latitudes and longitudes should be positive, and include a
 letter N,S,E, or W indicating north or south latitude, and
 east or west longitude. For example,
 35.9 N Latitude = 35.9N
 118.7 E Longitude = 118.7E

Datum-region

The Datum-Region for the coordinates is identified by a character string. Many mapping products currently available use the model of the Earth known as the world Geodetic System 1984 (WGS-84). Other local models may be in use, and their selection in CALMET will make its output consistent with local mapping products. The list of Datum-Regions with official transformation parameters is provided by the National Imagery and Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84	WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C	NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C	NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84	NWS 6370KM Radius, Sphere
ESR-S	ESRI REFERENCE 6371KM Radius, Sphere

Anna_Bay_Quarry_calmet.inp
Datum-region for output coordinates
(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

Horizontal grid definition:

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

No. X grid cells (NX)	No default	! NX = 100 !
No. Y grid cells (NY)	No default	! NY = 100 !
Grid spacing (DGRIDKM)	No default Units: km	! DGRIDKM = 0.1 !
Reference grid coordinate of SOUTHWEST corner of grid cell (1,1)		
X coordinate (XORIGKM)	No default	! XORIGKM = 408 !
Y coordinate (YORIGKM)	No default Units: km	! YORIGKM = 6370 !

Vertical grid definition:

No. of vertical layers (NZ)	No default	! NZ = 10 !
Cell face heights in arbitrary vertical grid (ZFACE(NZ+1))	No defaults Units: m	
! ZFACE = 0,20,40,80,160,320,700,1300,1700,2300,3000 !		

!END!

INPUT GROUP: 3 -- Output Options

DISK OUTPUT OPTION

Save met. fields in an unformatted output file ? (LSAVE) (F = Do not save, T = Save)	Default: T	! LSAVE = T !
Type of unformatted output file: (IFORMO)	Default: 1	! IFORMO = 1 !
1 = CALPUFF/CALGRID type file (CALMET.DAT) 2 = MESOPUFF-II type file (PACOUT.DAT)		

LINE PRINTER OUTPUT OPTIONS:

Print met. fields ? (LPRINT) (F = Do not print, T = Print) (NOTE: parameters below control which met. variables are printed)	Default: F	! LPRINT = F !
Print interval (IPRINF) in hours (Meteorological fields are printed every 1 hours)	Default: 1	! IPRINF = 1 !

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Specify which layers of U, V wind component
to print (IUROUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T) Defaults: NZ*0
! IUROUT = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !

Specify which levels of the W wind component to print
(NOTE: W defined at TOP cell face -- 10 values)
(IWOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0
! IWOUT = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !

Specify which levels of the 3-D temperature field to print
(ITOUT(NZ)) -- NOTE: NZ values must be entered
(0=Do not print, 1=Print)
(used only if LPRINT=T & LCALGRD=T)

Defaults: NZ*0
! ITOUT = 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0 !

Specify which meteorological fields
to print
(used only if LPRINT=T) Defaults: 0 (all variables)

Variable	Print ? (0 = do not print, 1 = print)	
-----	-----	
! STABILITY =	0	! - PGT stability class
! USTAR =	0	! - Friction velocity
! MONIN =	0	! - Monin-Obukhov length
! MIXHT =	0	! - Mixing height
! WSTAR =	0	! - Convective velocity scale
! PRECIP =	0	! - Precipitation rate
! SENSHEAT =	0	! - Sensible heat flux
! CONVZI =	0	! - Convective mixing ht.

Testing and debug print options for micrometeorological module

Print input meteorological data and
internal variables (LDB) Default: F ! LDB = F !
(F = Do not print, T = print)
(NOTE: this option produces large amounts of output)

First time step for which debug data
are printed (NN1) Default: 1 ! NN1 = 1 !

Last time step for which debug data
are printed (NN2) Default: 1 ! NN2 = 1 !

Print distance to land
internal variables (LDBCST) Default: F ! LDBCST = F !
(F = Do not print, T = print)
(Output in .GRD file DCST.GRD, defined in input group 0)

Testing and debug print options for wind field module (all of the following print options control output to

Anna_Bay_Quarry_calmet.inp
 wind field module's output files: TEST.PRT, TEST.OUT,
 TEST.KIN, TEST.FRD, and TEST.SLP)

Control variable for writing the test/debug
 wind fields to disk files (IOUTD)
 (0=Do not write, 1=write) Default: 0 ! IOUTD = 0 !

Number of levels, starting at the surface,
 to print (NZPRN2) Default: 1 ! NZPRN2 = 0 !

Print the INTERPOLATED wind components ?
 (IPR0) (0=no, 1=yes) Default: 0 ! IPR0 = 0 !

Print the TERRAIN ADJUSTED surface wind
 components ?
 (IPR1) (0=no, 1=yes) Default: 0 ! IPR1 = 0 !

Print the SMOOTHED wind components and
 the INITIAL DIVERGENCE fields ?
 (IPR2) (0=no, 1=yes) Default: 0 ! IPR2 = 0 !

Print the FINAL wind speed and direction
 fields ?
 (IPR3) (0=no, 1=yes) Default: 0 ! IPR3 = 0 !

Print the FINAL DIVERGENCE fields ?
 (IPR4) (0=no, 1=yes) Default: 0 ! IPR4 = 0 !

Print the winds after KINEMATIC effects
 are added ?
 (IPR5) (0=no, 1=yes) Default: 0 ! IPR5 = 0 !

Print the winds after the FROUDE NUMBER
 adjustment is made ?
 (IPR6) (0=no, 1=yes) Default: 0 ! IPR6 = 0 !

Print the winds after SLOPE FLOWS
 are added ?
 (IPR7) (0=no, 1=yes) Default: 0 ! IPR7 = 0 !

Print the FINAL wind field components ?
 (IPR8) (0=no, 1=yes) Default: 0 ! IPR8 = 0 !

!END!

 INPUT GROUP: 4 -- Meteorological data options

NO OBSERVATION MODE (NOOBS) Default: 0 ! NOOBS = 2 !
 0 = Use surface, overwater, and upper air stations
 1 = Use surface and overwater stations (no upper air observations)
 Use MM4/MM5/3D.DAT for upper air data
 2 = No surface, overwater, or upper air observations
 Use MM4/MM5/3D.DAT for surface, overwater, and upper air data

NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

Number of surface stations (NSSTA) No default ! NSSTA = 3 !

Number of precipitation stations
 (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
 (NPSTA) No default ! NPSTA = -1 !

CLOUD DATA OPTIONS
 Gridded cloud fields:

```

                        Anna_Bay_Quarry_calmet.inp
                        (ICLOUD) Default: 0      ! ICLOUD = 4 !
ICLOUD = 0 - Gridded clouds not used
ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity
              at 850mb (Teixera)
ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity
              at all levels (MM5toGrads algorithm)

```

FILE FORMATS

```

Surface meteorological data file format
                        (IFORMS) Default: 2      ! IFORMS = 2 !
(1 = unformatted (e.g., SMERGE output))
(2 = formatted   (free-formatted user input))

Precipitation data file format
                        (IFORMP) Default: 2      ! IFORMP = 2 !
(1 = unformatted (e.g., PMERGE output))
(2 = formatted   (free-formatted user input))

Cloud data file format
                        (IFORMC) Default: 2      ! IFORMC = 2 !
(1 = unformatted - CALMET unformatted output)
(2 = formatted   - free-formatted CALMET output or user input)

```

!END!

INPUT GROUP: 5 -- Wind Field Options and Parameters

WIND FIELD MODEL OPTIONS

```

Model selection variable (IWFCOD)      Default: 1      ! IWFCOD = 1 !
    0 = Objective analysis only
    1 = Diagnostic wind module

Compute Froude number adjustment
effects ? (IFRADJ)                      Default: 1      ! IFRADJ = 1 !
(0 = NO, 1 = YES)

Compute kinematic effects ? (IKINE)     Default: 0      ! IKINE  = 0 !
(0 = NO, 1 = YES)

Use O'Brien procedure for adjustment
of the vertical velocity ? (IOBR)       Default: 0      ! IOBR   = 0 !
(0 = NO, 1 = YES)

Compute slope flow effects ? (ISLOPE)   Default: 1      ! ISLOPE = 1 !
(0 = NO, 1 = YES)

Extrapolate surface wind observations
to upper layers ? (IEXTRP)              Default: -4      ! IEXTRP = 4 !
(1 = no extrapolation is done,
 2 = power law extrapolation used,
 3 = user input multiplicative factors
    for layers 2 - NZ used (see FEXTRP array)
 4 = similarity theory used
-1, -2, -3, -4 = same as above except layer 1 data
                  at upper air stations are ignored

Extrapolate surface winds even
if calm? (ICALM)                        Default: 0      ! ICALM  = 0 !
(0 = NO, 1 = YES)

```

Anna_Bay_Quarry_calmet.inp
 Layer-dependent biases modifying the weights of
 surface and upper air stations (BIAS(NZ))

-1<=BIAS<=1

Negative BIAS reduces the weight of upper air stations

(e.g. BIAS=-0.1 reduces the weight of upper air stations
 by 10%; BIAS= -1, reduces their weight by 100 %)

Positive BIAS reduces the weight of surface stations

(e.g. BIAS= 0.2 reduces the weight of surface stations
 by 20%; BIAS=1 reduces their weight by 100%)

Zero BIAS leaves weights unchanged (1/R**2 interpolation)

Default: NZ*0

! BIAS = -1.0,-1.0,-1.0,-1.0,0.0,1.0,1.0,1.0,1.0 !

Minimum distance from nearest upper air station

to surface station for which extrapolation

of surface winds at surface station will be allowed

(RMIN2: Set to -1 for IEXTRP = 4 or other situations

where all surface stations should be extrapolated)

Default: 4. ! RMIN2 = 4.0 !

Use gridded prognostic wind field model
 output fields as input to the diagnostic

wind field model (IPROG)

Default: 0 ! IPROG = 14 !

(0 = No, [IWFCOD = 0 or 1]

1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]

2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD = 1]

3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD = 0]

4 = Yes, use winds from MM4.DAT file as initial guess field [IWFCOD = 1]

5 = Yes, use winds from MM4.DAT file as observations [IWFCOD = 1]

13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD = 0]

14 = Yes, use winds from MM5/3D.DAT file as initial guess field [IWFCOD

= 1]

15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD = 1]

Timestep (seconds) of the prognostic

model input data (ISTEPPGS)

Default: 3600 ! ISTEPPGS = 3600

!

Use coarse CALMET fields as initial guess fields (IGFMET)

(overwrites IGF based on prognostic wind fields if any)

Default: 0 ! IGFMET = 0 !

RADIUS OF INFLUENCE PARAMETERS

Use varying radius of influence

Default: F

! LVARY = F !

(if no stations are found within RMAX1,RMAX2,
 or RMAX3, then the closest station will be used)

Maximum radius of influence over land
 in the surface layer (RMAX1)

No default

! RMAX1 = 10 !

Units: km

Maximum radius of influence over land
 aloft (RMAX2)

No default

! RMAX2 = 10 !

Units: km

Maximum radius of influence over water
 (RMAX3)

No default

! RMAX3 = 10 !

Units: km

OTHER WIND FIELD INPUT PARAMETERS

Minimum radius of influence used in
 the wind field interpolation (RMIN)

Default: 0.1

! RMIN = 0.1 !

Units: km

Radius of influence of terrain
 features (TERRAD)

No default

! TERRAD = 6 !

Units: km


```

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Y coordinate of BEGINNING
of each barrier (YBBAR(NBAR))          ! YBBAR = 0. !

X coordinate of ENDING
of each barrier (XEBAR(NBAR))          ! XEBAR = 0. !
Y coordinate of ENDING
of each barrier (YEBAR(NBAR))          ! YEBAR = 0. !

```

DIAGNOSTIC MODULE DATA INPUT OPTIONS

```

Surface temperature (IDIOPT1)          Default: 0      ! IDIOPT1 = 0  !
0 = Compute internally from
    hourly surface observations or prognostic fields
1 = Read preprocessed values from
    a data file (DIAG.DAT)

```

```

Surface met. station to use for
the surface temperature (ISURFT)      Default: -1    ! ISURFT = -1  !
(Must be a value from 1 to NSSTA,
 or -1 to use 2-D spatially varying
    surface temperatures,
 or -2 to use a domain-average prognostic
    surface temperatures (only with ITPROG=2))
(Used only if IDIOPT1 = 0)
-----

```

```

Temperature lapse rate used in the    Default: 0      ! IDIOPT2 = 0  !
computation of terrain-induced
circulations (IDIOPT2)
0 = Compute internally from (at least) twice-daily
    upper air observations or prognostic fields
1 = Read hourly preprocessed values
    from a data file (DIAG.DAT)

```

```

Upper air station to use for
the domain-scale lapse rate (IUPT)   Default: -1    ! IUPT   = -1  !
(Must be a value from 1 to NUSTA,
 or -1 to use 2-D spatially varying lapse rate,
 or -2 to use a domain-average prognostic
    lapse rate (only with ITPROG>0))
(Used only if IDIOPT2 = 0)
-----

```

```

Depth through which the domain-scale
lapse rate is computed (ZUPT)        Default: 200.  ! ZUPT = 200. !
(Used only if IDIOPT2 = 0)           Units: meters
-----

```

```

Initial Guess Field winds
(IDIOPT3)                            Default: 0      ! IDIOPT3 = 0  !
0 = Compute internally from
    observations or prognostic wind fields
1 = Read hourly preprocessed domain-average wind values
    from a data file (DIAG.DAT)

```

```

Upper air station to use for
the initial guess winds (IUPWND)     Default: -1    ! IUPWND = -1  !
(Must be a value from -1 to NUSTA, with
-1 indicating 3-D initial guess fields,
and IUPWND>1 domain-scaled (i.e. constant) IGF)
(Used only if IDIOPT3 = 0 and noobs=0)
-----

```

```

Bottom and top of layer through
which the domain-scale winds
are computed
(ZUPWND(1), ZUPWND(2))               Defaults: 1., 1000. ! ZUPWND= 1., 1000.

```

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!

(Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0) Units: meters

Observed surface wind components
for wind field module (IDIOPT4) Default: 0 ! IDIOPT4 = 0 !
0 = Read WS, WD from a surface
data file (SURF.DAT)
1 = Read hourly preprocessed U, V from
a data file (DIAG.DAT)

Observed upper air wind components
for wind field module (IDIOPT5) Default: 0 ! IDIOPT5 = 0 !
0 = Read WS, WD from an upper
air data file (UP1.DAT, UP2.DAT, etc.)
1 = Read hourly preprocessed U, V from
a data file (DIAG.DAT)

LAKE BREEZE INFORMATION

Use Lake Breeze Module (LLBREZE)
Default: F ! LLBREZE = F !

Number of lake breeze regions (NBOX) ! NBOX = 0 !

X Grid line 1 defining the region of interest ! XG1 = 0. !
X Grid line 2 defining the region of interest ! XG2 = 0. !
Y Grid line 1 defining the region of interest ! YG1 = 0. !
Y Grid line 2 defining the region of interest ! YG2 = 0. !

X Point defining the coastline (Straight line)
(XBCST) (KM) Default: none ! XBCST = 0. !

Y Point defining the coastline (Straight line)
(YBCST) (KM) Default: none ! YBCST = 0. !

X Point defining the coastline (Straight line)
(XECST) (KM) Default: none ! XECST = 0. !

Y Point defining the coastline (Straight line)
(YECST) (KM) Default: none ! YECST = 0. !

Number of stations in the region Default: none ! NLB = 0 !
(Surface stations + upper air stations)

Station ID's in the region (METBXID(NLB))
(Surface stations first, then upper air stations)
! METBXID = 0 !

!END!

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation Parameters

EMPIRICAL MIXING HEIGHT CONSTANTS

Neutral, mechanical equation
(CONSTB) Default: 1.41 ! CONSTB = 1.41 !
Convective mixing ht. equation
(CONSTE) Default: 0.15 ! CONSTE = 0.15 !

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Stable mixing ht. equation
(CONSTN) Default: 2400. ! CONSTN = 2400.!

Overwater mixing ht. equation
(CONSTW) Default: 0.16 ! CONSTW = 0.16 !

Absolute value of Coriolis
parameter (FCORIOL) Default: 1.E-4 ! FCORIOL =
1.0E-04!

Units: (1/s)

SPATIAL AVERAGING OF MIXING HEIGHTS

Conduct spatial averaging
(IAVEZI) (0=no, 1=yes) Default: 1 ! IAVEZI = 1 !

Max. search radius in averaging
process (MNMDAV) Default: 1 ! MNMDAV = 1 !
Units: Grid
cells

Half-angle of upwind looking cone
for averaging (HAFANG) Default: 30. ! HAFANG = 30. !
Units: deg.

Layer of winds used in upwind
averaging (ILEVZI) Default: 1 ! ILEVZI = 1 !
(must be between 1 and NZ)

CONVECTIVE MIXING HEIGHT OPTIONS:

Method to compute the convective
mixing height(IMIHXH) Default: 1 ! IMIXH = 1 !

1: Maul-Carson for land and water cells
-1: Maul-Carson for land cells only -
OCD mixing height overwater
2: Batchvarova and Gryning for land and water cells
-2: Batchvarova and Gryning for land cells only
OCD mixing height overwater

Threshold buoyancy flux required to
sustain convective mixing height growth
overland (THRESHL) Default: 0.0 ! THRESHL = 0. !
(expressed as a heat flux units: W/m³
per meter of boundary layer)

Threshold buoyancy flux required to
sustain convective mixing height growth
overwater (THRESHW) Default: 0.05 ! THRESHW = 0.05 !
(expressed as a heat flux units: W/m³
per meter of boundary layer)

Flag to allow relaxation of convective mixing height
to equilibrium value when 0<QH<THRESHL (overland)
or 0<QH<THRESHW (overwater)
(IZICRLX) Default: 1 ! IZICRLX = 1 !

0 : do NOT use convective mixing height relaxation
to equilibrium value (treatment identical to CALMET v5.8)
1 : use convective mixing height relaxation
to equilibrium value

Relaxation time of convective mixing height to
equilibrium value when 0<QH<THRESHL (overland)
or 0<QH<THRESHW (overwater)
(Used only if IZICRLX = 1 and TZICRLX must be >= 1.)
(TZICRLX) Default: 800. ! TZICRLX = 800. !
Units: seconds

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option for overwater lapse rates used
in convective mixing height growth
(ITWPROG) Default: 0 ! ITWPROG = 0 !
0 : use SEA.DAT lapse rates and deltaT (or assume neutral
conditions if missing)
1 : use prognostic lapse rates (only if IPROG>2)
and SEA.DAT deltaT (or neutral if missing)
2 : use prognostic lapse rates and prognostic delta T
(only if iprog>12 and 3D.DAT version# 2.0 or higher)

Land Use category ocean in 3D.DAT datasets
(ILUOC3D) Default: 16 ! ILUOC3D = 16 !
Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
if MM4.DAT, typically iluoc3d = 7

OTHER MIXING HEIGHT VARIABLES

Minimum potential temperature lapse
rate in the stable layer above the
current convective mixing ht.
(DPTMIN) Default: 0.001 ! DPTMIN = 0.001 !
Units: deg. K/m

Depth of layer above current conv.
mixing height through which lapse
rate is computed (DZZI) Default: 200. ! DZZI = 200. !
Units: meters

Minimum overland mixing height
(ZIMIN) Default: 50. ! ZIMIN = 50. !
Units: meters

Maximum overland mixing height
(ZIMAX) Default: 3000. ! ZIMAX = 3000. !
Units: meters

Minimum overwater mixing height
(ZIMINW) -- (Not used if observed
overwater mixing hts. are used) Default: 50. ! ZIMINW = 50. !
Units: meters

Maximum overwater mixing height
(ZIMAXW) -- (Not used if observed
overwater mixing hts. are used) Default: 3000. ! ZIMAXW = 3000. !
Units: meters

OVERWATER SURFACE FLUXES METHOD and PARAMETERS

(ICOARE) Default: 10 ! ICOARE = 10 !
0: original deltaT method (OCD)
10: COARE with no wave parameterization (jwave=0, Charnock)
11: COARE with wave option jwave=1 (Oost et al.)
and default wave properties
-11: COARE with wave option jwave=1 (Oost et al.)
and observed wave properties (must be in SEA.DAT files)
12: COARE with wave option 2 (Taylor and Yelland)
and default wave properties
-12: COARE with wave option 2 (Taylor and Yelland)
and observed wave properties (must be in SEA.DAT files)

Note: when ICOARE=0, similarity wind profile stability PSI functions
based on Van Ulden and Holtslag (1985) are substituted for
later formulations used with the COARE module, and temperatures
used for surface layer parameters are obtained from either the
nearest surface station temperature or prognostic model 2D
temperatures (if ITPROG=2).

Coastal/shallow water length scale (DSHELF)
(for modified z0 in shallow water)
(COARE fluxes only)

Default : 0. ! DSHELF = 0. !
units: km

COARE warm layer computation (IWARM) ! IWARM = 0 !
1: on - 0: off (must be off if SST measured with
IR radiometer) Default: 0

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COARE cool skin layer computation (ICOOL) ! ICOOL = 0 !
 1: on - 0: off (must be off if SST measured with
 IR radiometer) Default: 0

RELATIVE HUMIDITY PARAMETERS

3D relative humidity from observations or
 from prognostic data? (IRHPROG) Default: 0 ! IRHPROG = 0 !

- 0 = Use RH from SURF.DAT file
 (only if NOOBS = 0,1)
- 1 = Use prognostic RH
 (only if NOOBS = 0,1,2)

TEMPERATURE PARAMETERS

3D temperature from observations or
 from prognostic data? (ITPROG) Default: 0 ! ITPROG = 2 !

- 0 = Use Surface and upper air stations
 (only if NOOBS = 0)
- 1 = Use Surface stations (no upper air observations)
 Use MM5/3D.DAT for upper air data
 (only if NOOBS = 0,1)
- 2 = No surface or upper air observations
 Use MM5/3D.DAT for surface and upper air data
 (only if NOOBS = 0,1,2)

Interpolation type
 (1 = 1/R ; 2 = 1/R**2) Default: 1 ! IRAD = 1 !

Radius of influence for temperature
 interpolation (TRADKM) Default: 500. ! TRADKM = 500. !
 Units: km

Maximum Number of stations to include
 in temperature interpolation (NUMTS) Default: 5 ! NUMTS = 5 !

Conduct spatial averaging of temp-
 eratures (IAVET) (0=no, 1=yes) Default: 1 ! IAVET = 1 !
 (will use mixing ht MNMDAV, HAFANG
 so make sure they are correct)

Default temperature gradient
 -0.0098 ! Default: -.0098 ! TGDEFB =
 below the mixing height over
 water (TGDEFB) Units: K/m

Default temperature gradient
 -0.0045 ! Default: -.0045 ! TGDEFA =
 above the mixing height over
 water (TGDEFA) Units: K/m

Beginning (JWAT1) and ending (JWAT2)
 land use categories for temperature
 interpolation over water -- Make ! JWAT1 = 55 !
 bigger than largest land use to disable ! JWAT2 = 55 !

PRECIP INTERPOLATION PARAMETERS

Method of interpolation (NFLAGP) Default: 2 ! NFLAGP = 2 !
 (1=1/R, 2=1/R**2, 3=EXP/R**2)

Radius of Influence (SIGMAP) Default: 100.0 ! SIGMAP = 100. !
 (0.0 => use half dist. btwn
 nearest stns w & w/out
 precip when NFLAGP = 3)
 Units: km

Minimum Precip. Rate Cutoff (CUTP) Default: 0.01 ! CUTP = 0.01 !

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(values < CUTP = 0.0 mm/hr) Units: mm/hr

!END!

INPUT GROUP: 7 -- Surface meteorological station parameters

SURFACE STATION VARIABLES
(One record per station -- 3 records in all)

	1 Name	2 ID	X coord. (km)	Y coord. (km)	Time zone	Anem. Ht. (m)
! SS1	= 'WILL'	61078	390.994	6371.05	-10	10 !
! SS2	= 'NOB'	61055	387.653	6357.113	-10	10 !
! SS3	= 'TAC'	10001	381.193	6368.23	-10	10 !

1
Four character string for station name
(MUST START IN COLUMN 9)

2
Six digit integer for station ID

!END!

INPUT GROUP: 8 -- Upper air meteorological station parameters

UPPER AIR STATION VARIABLES
(One record per station -- 0 records in all)

1 Name	2 ID	X coord. (km)	Y coord. (km)	Time zone
-----------	---------	------------------	------------------	-----------

1
Four character string for station name
(MUST START IN COLUMN 9)

2
Five digit integer for station ID

!END!

INPUT GROUP: 9 -- Precipitation station parameters

PRECIPITATION STATION VARIABLES
(One record per station -- -1 records in all)
(NOT INCLUDED IF NPSTA = 0)

1 Name	2 Station Code	X coord. (km)	Y coord. (km)
-----------	----------------------	------------------	------------------

1
Four character string for station name

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(MUST START IN COLUMN 9)

2

Six digit station code composed of state
code (first 2 digits) and station ID (last
4 digits)

!END!

----- Run title (3 lines) -----

CALPUFF MODEL CONTROL FILE

INPUT GROUP: 0 -- Input and Output File Names

Default Name	Type	File Name
CALMET.DAT	input	! METDAT = C:\15339\anna_bay_quarry_calmet.DAT !
or		
ISCMET.DAT	input	* ISCDAT = *
or		
PLMMET.DAT	input	* PLMDAT = *
or		
PROFILE.DAT	input	* PRFDAT = *
SURFACE.DAT	input	* SFCDAT = *
RESTARTB.DAT	input	* RSTARTB= *
CALPUFF.LST	output	! PUFLST = Anna_Bay_Quarry_calpuff_FEL.lst !
CONC.DAT	output	! CONDAT = Anna_Bay_Quarry_calpuff_FEL.con !
DFLX.DAT	output	! DFDAT = Anna_Bay_Quarry_calpuff_FEL.dry !
WFLX.DAT	output	* WFDAT = *
VISB.DAT	output	* VISDAT = *
TK2D.DAT	output	* T2DDAT = *
RHO2D.DAT	output	* RHODAT = *
RESTARTE.DAT	output	* RSTARTE= *

Emission Files

PTEMARB.DAT	input	* PTDAT = *
VOLEMARB.DAT	input	! VOLDAT = AnnaBay_FEL_VOLEMARB_Rev4.DAT !
BAEMARB.DAT	input	* ARDAT = *
LNEMARB.DAT	input	* LNDAT = *

Other Files

OZONE.DAT	input	* OZDAT = *
VD.DAT	input	* VDDAT = *
CHEM.DAT	input	* CHEMDAT= *
AUX	input	* AUXEXT = *
(Extension added to METDAT filename(s) for files with auxiliary 2D and 3D data)		
H2O2.DAT	input	* H2O2DAT= *
NH3Z.DAT	input	* NH3ZDAT= *
HILL.DAT	input	* HILDAT= *
HILLRCT.DAT	input	* RCTDAT= *
COASTLN.DAT	input	* CSTDAT= *
FLUXBDY.DAT	input	* BDYDAT= *
BCON.DAT	input	* BCNDAT= *
DEBUG.DAT	output	* DEBUG = *
MASSFLX.DAT	output	* FLXDAT= *
MASSBAL.DAT	output	* BALDAT= *
FOG.DAT	output	* FOGDAT= *
RISE.DAT	output	* RISDAT= *

All file names will be converted to lower case if LCFILES = T
 Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
 T = lower case ! LCFILES = T !
 F = UPPER CASE

NOTE: (1) file/path names can be up to 132 characters in length

Provision for multiple input files

```

Number of Modeling Domains (NMETDOM)
                        Default: 1      ! NMETDOM = 1  !

Number of CALMET.DAT files for run (NMETDAT)
                        Default: 1      ! NMETDAT = 1  !

Number of PTEMARB.DAT files for run (NPTDAT)
                        Default: 0      ! NPTDAT = 0   !

Number of BAEMARB.DAT files for run (NARDAT)
                        Default: 0      ! NARDAT = 0   !

Number of VOLEMARB.DAT files for run (NVOLDAT)
                        Default: 0      ! NVOLDAT = 0   !

```

!END!

Subgroup (0a)

Provide a name for each CALMET domain if NMETDOM > 1
Enter NMETDOM lines.

```

                        a,b
Default Name          Domain Name
-----
none                  * DOMAIN= * *END*

```

The following CALMET.DAT filenames are processed in sequence
if NMETDAT > 1

Enter NMETDAT lines, 1 line for each file name.

```

                        a,c,d
Default Name  Type      File Name
-----
none          input    * METDAT= * *END*

```

- a
The name for each CALMET domain and each CALMET.DAT file is treated as a separate input subgroup and therefore must end with an input group(terminator).
- b
Use DOMAIN1= to assign the name for the outermost CALMET domain.
Use DOMAIN2= to assign the name for the next inner CALMET domain.
Use DOMAIN3= to assign the name for the next inner CALMET domain, etc.

```

-----
| when inner domains with equal resolution (grid-cell size) |
| overlap, the data from the FIRST such domain in the list will |
| be used if all other criteria for choosing the controlling |
| grid domain are inconclusive. |
-----

```

- c
Use METDAT1= to assign the file names for the outermost CALMET domain.
Use METDAT2= to assign the file names for the next inner CALMET domain.
Use METDAT3= to assign the file names for the next inner CALMET domain,
etc.

- d
The filenames for each domain must be provided in sequential order

Subgroup (0b)

The following PTEMARB.DAT filenames are processed if NPTDAT>0
(Each file contains a subset of the sources, for the entire simulation)

Default Name	Type	File Name
none	input	* PTDAT= * *END*

Subgroup (0c)

The following BAEMARB.DAT filenames are processed if NARDAT>0
(Each file contains a subset of the sources, for the entire simulation)

Default Name	Type	File Name
none	input	* ARDAT= * *END*

Subgroup (0d)

The following VOLEMARB.DAT filenames are processed if NVOLDAT>0
(Each file contains a subset of the sources, for the entire simulation)

Default Name	Type	File Name
none	input	* VOLDAT= * *END*

INPUT GROUP: 1 -- General run control parameters

Option to run all periods found
in the met. file (METRUN) Default: 0 ! METRUN = 0 !

METRUN = 0 - Run period explicitly defined below
METRUN = 1 - Run all periods in met. file

Starting date:	Year (IBYR) --	No default	! IBYR = 2010 !
	Month (IBMO) --	No default	! IBMO = 1 !
	Day (IBDY) --	No default	! IBDY = 1 !
Starting time:	Hour (IBHR) --	No default	! IBHR = 1 !
	Minute (IBMIN) --	No default	! IBMIN = 0 !
	Second (IBSEC) --	No default	! IBSEC = 0 !
Ending date:	Year (IEYR) --	No default	! IEYR = 2011 !
	Month (IEMO) --	No default	! IEMO = 1 !
	Day (IEDY) --	No default	! IEDY = 1 !
Ending time:	Hour (IEHR) --	No default	! IEHR = 0 !
	Minute (IEMIN) --	No default	! IEMIN = 0 !
	Second (IESEC) --	No default	! IESEC = 0 !

(These are only used if METRUN = 0)

Base time zone: (ABTZ) -- No default ! ABTZ = UTC+1000 !
(character*8)

The modeling domain may span multiple time zones. ABTZ defines the base time zone used for the entire simulation. This must match the base time zone of the meteorological data.

Examples:

Anna_Bay_Quarry_calpuff_FEL.inp
 Los Angeles, USA = UTC-0800
 New York, USA = UTC-0500
 Santiago, Chile = UTC-0400
 Greenwich Mean Time (GMT) = UTC+0000
 Rome, Italy = UTC+0100
 Cape Town, S.Africa = UTC+0200
 Sydney, Australia = UTC+1000

Length of modeling time-step (seconds)
 Equal to update period in the primary
 meteorological data files, or an
 integer fraction of it (1/2, 1/3 ...)
 Must be no larger than 1 hour
 (NSECDT)

Default: 3600 ! NSECDT = 3600 !
 Units: seconds

Number of chemical species (NSPEC)

Default: 5 ! NSPEC = 3 !

Number of chemical species
 to be emitted (NSE)

Default: 3 ! NSE = 3 !

Flag to stop run after
 SETUP phase (ITEST)
 (Used to allow checking
 of the model inputs, files, etc.)

Default: 2 ! ITEST = 2 !

ITEST = 1 - STOPS program after SETUP phase
 ITEST = 2 - Continues with execution of program
 after SETUP

Restart Configuration:

Control flag (MRESTART) Default: 0 ! MRESTART = 0 !

0 = Do not read or write a restart file
 1 = Read a restart file at the beginning of
 the run
 2 = Write a restart file during run
 3 = Read a restart file at beginning of run
 and write a restart file during run

Number of periods in Restart
 output cycle (NRESPD)

Default: 0 ! NRESPD = 0 !

0 = File written only at last period
 >0 = File updated every NRESPD periods

Meteorological Data Format (METFM)

Default: 1 ! METFM = 1 !

METFM = 1 - CALMET binary file (CALMET.MET)
 METFM = 2 - ISC ASCII file (ISCMET.MET)
 METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
 METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
 surface parameters file (SURFACE.DAT)
 METFM = 5 - AERMET tower file (PROFILE.DAT) and
 surface parameters file (SURFACE.DAT)

Meteorological Profile Data Format (MPRFFM)

(used only for METFM = 1, 2, 3)

Default: 1 ! MPRFFM = 1 !

MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
 MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2

Averaging Time (minutes) (AVET)

Default: 60.0 ! AVET = 60. !

Anna_Bay_Quarry_calpuff_FEL.inp
 PG Averaging Time (minutes) (PGTIME)
 Default: 60.0 ! PGTIME = 60. !

Output units for binary concentration and flux files
 written in Dataset v2.2 or later formats
 (IOUTU) Default: 1 ! IOUTU = 1 !
 1 = mass - g/m3 (conc) or g/m2/s (dep)
 2 = odour - odour_units (conc)
 3 = radiation - Bq/m3 (conc) or Bq/m2/s (dep)

Output Dataset format for binary concentration
 and flux files (e.g., CONC.DAT)
 (IOVERS) Default: 2 ! IOVERS = 2 !
 1 = Dataset Version 2.1
 2 = Dataset Version 2.2

!END!

INPUT GROUP: 2 -- Technical options

Vertical distribution used in the
 near field (MGAUSS) Default: 1 ! MGAUSS = 1 !
 0 = uniform
 1 = Gaussian

Terrain adjustment method
 (MCTADJ) Default: 3 ! MCTADJ = 3 !
 0 = no adjustment
 1 = ISC-type of terrain adjustment
 2 = simple, CALPUFF-type of terrain
 adjustment
 3 = partial plume path adjustment

Subgrid-scale complex terrain
 flag (MCTSG) Default: 0 ! MCTSG = 0 !
 0 = not modeled
 1 = modeled

Near-field puffs modeled as
 elongated slugs? (MSLUG) Default: 0 ! MSLUG = 0 !
 0 = no
 1 = yes (slug model used)

Transitional plume rise modeled?
 (MTRANS) Default: 1 ! MTRANS = 1 !
 0 = no (i.e., final rise only)
 1 = yes (i.e., transitional rise computed)

Stack tip downwash? (MTIP) Default: 1 ! MTIP = 1 !
 0 = no (i.e., no stack tip downwash)
 1 = yes (i.e., use stack tip downwash)

Method used to compute plume rise for
 point sources not subject to building
 downwash? (MRISE) Default: 1 ! MRISE = 1 !
 1 = Briggs plume rise
 2 = Numerical plume rise

Method used to simulate building
 downwash? (MBDW) Default: 1 ! MBDW = 1 !

1 = ISC method
2 = PRIME method

Vertical wind shear modeled above
stack top (modified Briggs plume rise)?

(MSHEAR) Default: 0 ! MSHEAR = 0 !
0 = no (i.e., vertical wind shear not modeled)
1 = yes (i.e., vertical wind shear modeled)

Puff splitting allowed? (MSPLIT) Default: 0 ! MSPLIT = 0 !
0 = no (i.e., puffs not split)
1 = yes (i.e., puffs are split)

Chemical mechanism flag (MCHEM) Default: 1 ! MCHEM = 0 !
0 = chemical transformation not modeled
1 = transformation rates computed internally (MESOPUFF II scheme)
2 = user-specified transformation rates used
3 = transformation rates computed internally (RIVAD/ARM3 scheme)
4 = secondary organic aerosol formation computed (MESOPUFF II scheme for OH)
5 = user-specified half-life with or without transfer to child species
6 = transformation rates computed internally (Updated RIVAD scheme with ISORROPIA equilibrium)
7 = transformation rates computed internally (Updated RIVAD scheme with ISORROPIA equilibrium and CalTech SOA)

Aqueous phase transformation flag (MAQCHEM)
(Used only if MCHEM = 6, or 7) Default: 0 ! MAQCHEM = 0 !
0 = aqueous phase transformation not modeled
1 = transformation rates and wet scavenging coefficients adjusted for in-cloud aqueous phase reactions (adapted from RADCM cloud model implementation in CMAQ/SCICHEM)

Liquid Water Content flag (MLWC)
(Used only if MAQCHEM = 1) Default: 1 ! MLWC = 1 !
0 = water content estimated from cloud cover and presence of precipitation
1 = gridded cloud water data read from CALMET water content output files (filenames are the CALMET.DAT names PLUS the extension AUXEXT provided in Input Group 0)

Wet removal modeled ? (MWET) Default: 1 ! MWET = 0 !
0 = no
1 = yes

Dry deposition modeled ? (MDRY) Default: 1 ! MDRY = 1 !
0 = no
1 = yes
(dry deposition method specified for each species in Input Group 3)

Gravitational settling (plume tilt) modeled ? (MTILT) Default: 0 ! MTILT = 0 !
0 = no
1 = yes
(puff center falls at the gravitational

Anna_Bay_Quarry_calpuff_FEL.inp
settling velocity for 1 particle species)

Restrictions:

- MDRY = 1
- NSPEC = 1 (must be particle species as well)
- sg = 0 GEOMETRIC STANDARD DEVIATION in Group 8 is set to zero for a single particle diameter

Method used to compute dispersion coefficients (MDISP)

Default: 3 ! MDISP = 3 !

- 1 = dispersion coefficients computed from measured values of turbulence, sigma v, sigma w
- 2 = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (u^* , w^* , L, etc.)
- 3 = PG dispersion coefficients for RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients in urban areas
- 4 = same as 3 except PG coefficients computed using the MESOPUFF II eqns.
- 5 = CTDM sigmas used for stable and neutral conditions. For unstable conditions, sigmas are computed as in MDISP = 3, described above. MDISP = 5 assumes that measured values are read

Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)

(Used only if MDISP = 1 or 5) Default: 3 ! MTURBVW = 3 !

- 1 = use sigma-v or sigma-theta measurements from PROFILE.DAT to compute sigma-y (valid for METFM = 1, 2, 3, 4, 5)
- 2 = use sigma-w measurements from PROFILE.DAT to compute sigma-z (valid for METFM = 1, 2, 3, 4, 5)
- 3 = use both sigma-(v/theta) and sigma-w from PROFILE.DAT to compute sigma-y and sigma-z (valid for METFM = 1, 2, 3, 4, 5)
- 4 = use sigma-theta measurements from PLMMET.DAT to compute sigma-y (valid only if METFM = 3)

Back-up method used to compute dispersion when measured turbulence data are missing (MDISP2)

Default: 3 ! MDISP2 = 3 !

(used only if MDISP = 1 or 5)

- 2 = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (u^* , w^* , L, etc.)
- 3 = PG dispersion coefficients for RURAL areas (computed using the ISCST multi-segment approximation) and MP coefficients in urban areas
- 4 = same as 3 except PG coefficients computed using the MESOPUFF II eqns.

[DIAGNOSTIC FEATURE]

Method used for Lagrangian timescale for Sigma-y (used only if MDISP=1,2 or MDISP2=1,2)

(MTAULY) Default: 0 ! MTAULY = 0 !

- 0 = Draxler default 617.284 (s)
- 1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
- 10 < Direct user input (s) -- e.g., 306.9

[DIAGNOSTIC FEATURE]

Method used for Advective-Decay timescale for Turbulence (used only if MDISP=2 or MDISP2=2)

(MTAUADV) Default: 0 ! MTAUADV = 0 !

- 0 = No turbulence advection

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1 = Computed (OPTION NOT IMPLEMENTED)
10 < Direct user input (s) -- e.g., 800

Method used to compute turbulence sigma-v &
sigma-w using micrometeorological variables
(Used only if MDISP = 2 or MDISP2 = 2)
(MCTURB) Default: 1 ! MCTURB = 1 !
1 = Standard CALPUFF subroutines
2 = AERMOD subroutines

PG sigma-y,z adj. for roughness? Default: 0 ! MROUGH = 0 !
(MROUGH)
0 = no
1 = yes

Partial plume penetration of Default: 1 ! MPARTL = 1 !
elevated inversion modeled for
point sources?
(MPARTL)
0 = no
1 = yes

Partial plume penetration of Default: 1 ! MPARTLBA = 1 !
elevated inversion modeled for
buoyant area sources?
(MPARTLBA)
0 = no
1 = yes

Strength of temperature inversion Default: 0 ! MTINV = 0 !
provided in PROFILE.DAT extended records?
(MTINV)
0 = no (computed from measured/default gradients)
1 = yes

PDF used for dispersion under convective conditions? Default: 0 ! MPDF = 0 !
(MPDF)
0 = no
1 = yes

Sub-Grid TIBL module used for shore line? Default: 0 ! MSGTIBL = 0 !
(MSGTIBL)
0 = no
1 = yes

Boundary conditions (concentration) modeled? Default: 0 ! MBCON = 0 !
(MBCON)
0 = no
1 = yes, using formatted BCON.DAT file
2 = yes, using unformatted CONC.DAT file

Note: MBCON > 0 requires that the last species modeled
be 'BCON'. Mass is placed in species BCON when
generating boundary condition puffs so that clean
air entering the modeling domain can be simulated
in the same way as polluted air. Specify zero
emission of species BCON for all regular sources.

Individual source contributions saved? Default: 0 ! MSOURCE = 0 !
(MSOURCE)
0 = no
1 = yes

Anna_Bay_Quarry_calpuff_FEL.inp

Analyses of fogging and icing impacts due to emissions from arrays of mechanically-forced cooling towers can be performed using CALPUFF in conjunction with a cooling tower emissions processor (CTEMISS) and its associated postprocessors. Hourly emissions of water vapor and temperature from each cooling tower cell are computed for the current cell configuration and ambient conditions by CTEMISS. CALPUFF models the dispersion of these emissions and provides cloud information in a specialized format for further analysis. Output to FOG.DAT is provided in either 'plume mode' or 'receptor mode' format.

Configure for FOG Model output?

Default: 0 ! MFOG = 0 !

(MFOG)

0 = no

1 = yes - report results in PLUME Mode format

2 = yes - report results in RECEPTOR Mode format

Test options specified to see if they conform to regulatory values? (MREG)

Default: 1 ! MREG = 0 !

0 = NO checks are made

1 = Technical options must conform to USEPA

Long Range Transport (LRT) guidance

METFM 1 or 2

AVET 60. (min)

PGTIME 60. (min)

MGAUSS 1

MCTADJ 3

MTRANS 1

MTIP 1

MRISE 1

MCHEM 1 or 3 (if modeling SOx, NOx)

MWET 1

MDRY 1

MDISP 2 or 3

MPDF 0 if MDISP=3

1 if MDISP=2

MROUGH 0

MPARTL 1

MPARTLBA 0

SYTDEP 550. (m)

MHFTSZ 0

SVMIN 0.5 (m/s)

!END!

INPUT GROUP: 3a, 3b -- Species list

Subgroup (3a)

The following species are modeled:

! CSPEC = PM10 !

!END!

! CSPEC = TSP !

!END!

! CSPEC = PM2.5 !

!END!

Dry

OUTPUT

GROUP

```

                        Anna_Bay_Quarry_calpuff_FEL.inp
SPECIES                MODELED          EMITTED          DEPOSITED
NUMBER                (0=NO, 1=YES)      (0=NO, 1=YES)      (0=NO,
NAME                  (Limit: 12
(0=NONE,
CGRUP,                1=COMPUTED-GAS      1=1st
Characters
CGRUP,                2=COMPUTED-PARTICLE  2=2nd
in length)
etc.)                  3=USER-SPECIFIED)  3=
!      PM10=           1,                  1,                  2,                  0      !
!      TSP=            1,                  1,                  2,                  0      !
!      PM2.5=          1,                  1,                  2,                  0      !

!END!

```

Note: The last species in (3a) must be 'BCON' when using the boundary condition option (MBCON > 0). Species BCON should typically be modeled as inert (no chem transformation or removal).

----- Subgroup (3b) -----

The following names are used for Species-Groups in which results for certain species are combined (added) prior to output. The CGRUP name will be used as the species name in output files. Use this feature to model specific particle-size distributions by treating each size-range as a separate species. Order must be consistent with 3(a) above.

----- INPUT GROUP: 4 -- Map Projection and Grid control parameters -----

Projection for all (X,Y): -----

Map projection
(PMAP)

Default: UTM ! PMAP = UTM !

UTM : Universal Transverse Mercator
TTM : Tangential Transverse Mercator
LCC : Lambert Conformal Conic
PS : Polar Stereographic
EM : Equatorial Mercator
LAZA : Lambert Azimuthal Equal Area

False Easting and Northing (km) at the projection origin
(Used only if PMAP= TTM, LCC, or LAZA)

(FEAST) Default=0.0 ! FEAST = 0.000 !
(FNORTH) Default=0.0 ! FNORTH = 0.000 !

UTM zone (1 to 60)

(Used only if PMAP=UTM)

(IUTMZN) No Default ! IUTMZN = 56 !

Hemisphere for UTM projection?

(Used only if PMAP=UTM)

(UTMHEM) Default: N ! UTMHEM = S !

N : Northern hemisphere projection
S : Southern hemisphere projection

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Latitude and Longitude (decimal degrees) of projection origin
(Used only if PMAP= TTM, LCC, PS, EM, or LAZA)

(RLAT0) No Default ! RLAT0 = 0N !
(RLON0) No Default ! RLON0 = 0E !

TTM : RLON0 identifies central (true N/S) meridian of projection
RLAT0 selected for convenience
LCC : RLON0 identifies central (true N/S) meridian of projection
RLAT0 selected for convenience
PS : RLON0 identifies central (grid N/S) meridian of projection
RLAT0 selected for convenience
EM : RLON0 identifies central meridian of projection
RLAT0 is REPLACED by 0.0N (Equator)
LAZA: RLON0 identifies longitude of tangent-point of mapping plane
RLAT0 identifies latitude of tangent-point of mapping plane

Matching parallel(s) of latitude (decimal degrees) for projection
(Used only if PMAP= LCC or PS)

(XLAT1) No Default ! XLAT1 = 0N !
(XLAT2) No Default ! XLAT2 = 0N !

XLAT2 LCC : Projection cone slices through Earth's surface at XLAT1 and
PS : Projection plane slices through Earth at XLAT1
(XLAT2 is not used)

Note: Latitudes and longitudes should be positive, and include a
letter N,S,E, or W indicating north or south latitude, and
east or west longitude. For example,
35.9 N Latitude = 35.9N
118.7 E Longitude = 118.7E

Datum-region -----

The Datum-Region for the coordinates is identified by a character string. Many mapping products currently available use the model of the Earth known as the world Geodetic System 1984 (WGS-84). Other local models may be in use, and their selection in CALMET will make its output consistent with local mapping products. The list of Datum-Regions with official transformation parameters is provided by the National Imagery and Mapping Agency (NIMA).

NIMA Datum - Regions(Examples)

WGS-84 WGS-84 Reference Ellipsoid and Geoid, Global coverage (WGS84)
NAS-C NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS (NAD27)
NAR-C NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS (NAD83)
NWS-84 NWS 6370KM Radius, Sphere
ESR-S ESRI REFERENCE 6371KM Radius, Sphere

Datum-region for output coordinates
(DATUM) Default: WGS-84 ! DATUM = WGS-84 !

METEOROLOGICAL Grid:

Rectangular grid defined for projection PMAP,
with X the Easting and Y the Northing coordinate

No. X grid cells (NX) No default ! NX = 100 !
No. Y grid cells (NY) No default ! NY = 100 !
No. vertical layers (NZ) No default ! NZ = 10 !
Grid spacing (DGRIDKM) No default ! DGRIDKM = 0.1 !

Anna_Bay_Quarry_calpuff_FEL.inp
Units: km

Cell face heights
(ZFACE(nz+1)) No defaults
Units: m

! ZFACE = 0,20,40,80,160,320,700,1300,1700,2300,3000 !

Reference Coordinates
of SOUTHWEST corner of
grid cell(1, 1):

X coordinate (XORIGKM)	No default	! XORIGKM = 408 !
Y coordinate (YORIGKM)	No default	! YORIGKM = 6370 !
Units: km		

COMPUTATIONAL Grid:

The computational grid is identical to or a subset of the MET. grid.
The lower left (LL) corner of the computational grid is at grid point
(IBCOMP, JBCOMP) of the MET. grid. The upper right (UR) corner of the
computational grid is at grid point (IECOMP, JECOMP) of the MET. grid.
The grid spacing of the computational grid is the same as the MET. grid.

X index of LL corner (IBCOMP) (1 <= IBCOMP <= NX)	No default	! IBCOMP = 1 !
Y index of LL corner (JBCOMP) (1 <= JBCOMP <= NY)	No default	! JBCOMP = 1 !
X index of UR corner (IECOMP) (1 <= IECOMP <= NX)	No default	! IECOMP = 100 !
Y index of UR corner (JECOMP) (1 <= JECOMP <= NY)	No default	! JECOMP = 100 !

SAMPLING Grid (GRIDDED RECEPTORS):

The lower left (LL) corner of the sampling grid is at grid point
(IBSAMP, JBSAMP) of the MET. grid. The upper right (UR) corner of the
sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
The sampling grid must be identical to or a subset of the computational
grid. It may be a nested grid inside the computational grid.
The grid spacing of the sampling grid is DGRIDKM/MESHDN.

Logical flag indicating if gridded receptors are used (LSAMP) (T=yes, F=no)	Default: T	! LSAMP = F !
X index of LL corner (IBSAMP) (IBCOMP <= IBSAMP <= IECOMP)	No default	! IBSAMP = 1 !
Y index of LL corner (JBSAMP) (JBCOMP <= JBSAMP <= JECOMP)	No default	! JBSAMP = 1 !
X index of UR corner (IESAMP) (IBCOMP <= IESAMP <= IECOMP)	No default	! IESAMP = 100 !
Y index of UR corner (JESAMP) (JBCOMP <= JESAMP <= JECOMP)	No default	! JESAMP = 100 !

Nesting factor of the sampling grid (MESHDN)	Default: 1	! MESHDN = 1 !
---	------------	----------------

Anna_Bay_Quarry_calpuff_FEL.inp
(MESH DN is an integer >= 1)

!END!

INPUT GROUP: 5 -- Output Options

FILE ----	DEFAULT VALUE -----	VALUE THIS RUN -----
Concentrations (ICON)	1	! ICON = 1 !
Dry Fluxes (IDRY)	1	! IDRY = 1 !
Wet Fluxes (IWET)	1	! IWET = 0 !
2D Temperature (IT2D)	0	! IT2D = 0 !
2D Density (IRHO)	0	! IRHO = 0 !
Relative Humidity (IVIS) (relative humidity file is required for visibility analysis)	1	! IVIS = 0 !
Use data compression option in output file? (LCOMPRS)	Default: T	! LCOMPRS = T !

*

0 = Do not create file, 1 = create file

QA PLOT FILE OUTPUT OPTION:

Create a standard series of output files (e.g.
locations of sources, receptors, grids ...) suitable for plotting?

(IQAPLOT) Default: 1 ! IQAPLOT = 1 !
0 = no
1 = yes

DIAGNOSTIC PUFF-TRACKING OUTPUT OPTION:

Puff locations and properties reported to
PFTRAK.DAT file for postprocessing?

(IPFTRAK) Default: 0 ! IPFTRAK = 0 !
0 = no
1 = yes, update puff output at end of each timestep
2 = yes, update puff output at end of each sampling step

DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

Mass flux across specified boundaries
for selected species reported?

(IMFLX) Default: 0 ! IMFLX = 0 !
0 = no
1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
are specified in Input Group 0)

Mass balance for each species
reported?

(IMBAL) Default: 0 ! IMBAL = 0 !
0 = no
1 = yes (MASSBAL.DAT filename is
specified in Input Group 0)

NUMERICAL RISE OUTPUT OPTION:

Create a file with plume properties for each rise

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 increment, for each model timestep?
 This applies to sources modeled with numerical rise
 and is limited to ONE source in the run.
 (INRISE) Default: 0 ! INRISE = 0 !
 0 = no
 1 = yes (RISE.DAT filename is
 specified in Input Group 0)

LINE PRINTER OUTPUT OPTIONS:

Print concentrations (ICPRT) Default: 0 ! ICPRT = 1 !
 Print dry fluxes (IDPRT) Default: 0 ! IDPRT = 0 !
 Print wet fluxes (IWPRT) Default: 0 ! IWPRT = 0 !
 (0 = Do not print, 1 = Print)

Concentration print interval
 (ICFRQ) in timesteps Default: 1 ! ICFRQ = 1 !
 Dry flux print interval
 (IDFRQ) in timesteps Default: 1 ! IDFRQ = 1 !
 Wet flux print interval
 (IWFRQ) in timesteps Default: 1 ! IWFRQ = 1 !

Units for Line Printer Output
 (IPRTU) Default: 1 ! IPRTU = 3 !
 for for
 Concentration Deposition
 1 = g/m**3 g/m**2/s
 2 = mg/m**3 mg/m**2/s
 3 = ug/m**3 ug/m**2/s
 4 = ng/m**3 ng/m**2/s
 5 = Odour Units

Messages tracking progress of run
 written to the screen ?
 (IMESG) Default: 2 ! IMESG = 2 !
 0 = no
 1 = yes (advection step, puff ID)
 2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)

SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

WET FLUXES		CONCENTRATIONS		DRY FLUXES		
SOURCES		MASS FLUX				
SPECIES	PRINTED?	SAVED ON DISK?	PRINTED?	SAVED ON DISK?	PRINTED?	
/GROUP	SAVED ON DISK?	SAVED ON DISK?	SAVED ON DISK?	SAVED ON DISK?	SAVED ON DISK?	
PM10=	0,	1,	0,	1,	0,	
0,	0	!	0,	1,	0,	
TSP=	0,	1,	0,	1,	0,	
0,	0	!	0,	1,	0,	
PM2.5=	0,	1,	0,	1,	0,	
0,	0	!	0,	1,	0,	

Note: Species BCON (for MBCON > 0) does not need to be saved on disk.

OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

Logical for debug output
 (LDEBUG) Default: F ! LDEBUG = F !
 First puff to track
 (IPFDEB) Default: 1 ! IPFDEB = 1 !
 Number of puffs to track

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(NPFDEB) Default: 1 ! NPFDEB = 1 !
Met. period to start output
(NN1) Default: 1 ! NN1 = 1 !
Met. period to end output
(NN2) Default: 10 ! NN2 = 10 !

!END!

----- INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs -----

----- Subgroup (6a) -----

Number of terrain features (NHILL) Default: 0 ! NHILL = 0 !
Number of special complex terrain
receptors (NCTREC) Default: 0 ! NCTREC = 0 !
Terrain and CTSG Receptor data for
CTSG hills input in CTDM format ?
(MHILL) No Default ! MHILL = 2 !
1 = Hill and Receptor data created
by CTDM processors & read from
HILL.DAT and HILLRCT.DAT files
2 = Hill data created by OPTHILL &
input below in Subgroup (6b);
Receptor data in Subgroup (6c)
Factor to convert horizontal dimensions Default: 1.0 ! XHILL2M = 1.0 !
to meters (MHILL=1)
Factor to convert vertical dimensions Default: 1.0 ! ZHILL2M = 1.0 !
to meters (MHILL=1)
X-origin of CTDM system relative to No Default ! XCTDMKM = 0 !
CALPUFF coordinate system, in Kilometers (MHILL=1)
Y-origin of CTDM system relative to No Default ! YCTDMKM = 0 !
CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

----- Subgroup (6b) -----

1 **
HILL information

HILL SCALE 1 NO. (m)	XC SCALE 2 (km)	YC AMAX1 (km)	THETAH AMAX2 (deg.) (m)	ZGRID (m)	RELIEF (m)	EXPO 1 (m)	EXPO 2 (m)
-----	-----	-----	-----	-----	-----	-----	-----

----- Subgroup (6c) -----

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COMPLEX TERRAIN RECEPTOR INFORMATION

XRCT (km)	YRCT (km)	ZRCT (m)	XHH
-----	-----	-----	----

1

Description of Complex Terrain Variables:

XC, YC = Coordinates of center of hill
 THETAH = Orientation of major axis of hill (clockwise from North)
 ZGRID = Height of the 0 of the grid above mean sea level
 RELIEF = Height of the crest of the hill above the grid elevation
 EXPO 1 = Hill-shape exponent for the major axis
 EXPO 2 = Hill-shape exponent for the major axis
 SCALE 1 = Horizontal length scale along the major axis
 SCALE 2 = Horizontal length scale along the minor axis
 AMAX = Maximum allowed axis length for the major axis
 BMAX = Maximum allowed axis length for the major axis

 XRCT, YRCT = Coordinates of the complex terrain receptors
 ZRCT = Height of the ground (MSL) at the complex terrain Receptor
 XHH = Hill number associated with each complex terrain receptor
 (NOTE: MUST BE ENTERED AS A REAL NUMBER)

**

NOTE: DATA for each hill and CTSG receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases

SPECIES RESISTANCE NAME	DIFFUSIVITY HENRY'S LAW COEFFICIENT (cm**2/s) (dimensionless)	ALPHA STAR	REACTIVITY	MESOPHYLL (s/cm)
-----	-----	-----	-----	

!END!

INPUT GROUP: 8 -- Size parameters for dry deposition of particles

For SINGLE SPECIES, the mean and standard deviation are used to compute a deposition velocity for NINT (see group 9) size-ranges, and these are then averaged to obtain a mean deposition velocity.

For GROUPED SPECIES, the size distribution should be explicitly specified (by the 'species' in the group), and the standard deviation for each should be entered as 0. The model will then use the deposition velocity for the stated mean diameter.

SPECIES NAME	GEOMETRIC MASS MEAN DIAMETER	GEOMETRIC STANDARD DEVIATION
-----------------	---------------------------------	---------------------------------

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(microns) (microns)

```

!      PM10 =      10,      0 !
!      TSP  =      30,      0 !
!      PM2.5 =      2.5,      0 !

```

!END!

INPUT GROUP: 9 -- Miscellaneous dry deposition parameters

```

Reference cuticle resistance (s/cm)
(RCUTR)                      Default: 30    ! RCUTR = 30.0 !
Reference ground resistance (s/cm)
(RGR)                        Default: 10     ! RGR = 10.0 !
Reference pollutant reactivity
(REACTR)                     Default: 8      ! REACTR = 8.0 !

Number of particle-size intervals used to
evaluate effective particle deposition velocity
(NINT)                       Default: 9      ! NINT = 9 !

Vegetation state in unirrigated areas
(IVEG)                       Default: 1      ! IVEG = 1 !
IVEG=1 for active and unstressed vegetation
IVEG=2 for active and stressed vegetation
IVEG=3 for inactive vegetation

```

!END!

INPUT GROUP: 10 -- Wet Deposition Parameters

```

                Scavenging Coefficient -- Units: (sec)**(-1)
Pollutant      Liquid Precip.      Frozen Precip.
-----

```

!END!

INPUT GROUP: 11a, 11b -- Chemistry Parameters

Subgroup (11a)

Several parameters are needed for one or more of the chemical transformation mechanisms. Those used for each mechanism are:

	M					B			
	A	B	R	R	R	C	B		N
B	V	C	N	N	N	M	K	O	D

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	M	C	M	G	K	I	I	I	H	H	K	F	V	E
	O	O	H	H	H	E	E	E	O	O	M	A	N	A
Mechanism (MCHEM)	Z	3	3	3	3	1	2	3	2	2	F	C	X	Y
0 None	.	.	.	.	.	.	.	.	.	.	.	.	.	.
1 MESOPUFF II	X	X	.	.	X	X	X	X	.	.	.	.	.	.
2 User Rates	.	.	.	.	.	.	.	.	.	.	.	.	.	.
3 RIVAD	X	X	.	.	X	.	.	.	.	.	.	.	.	.
4 SOA	X	X	.	.	.	.	.	.	.	.	X	X	X	.
5 Radioactive Decay	.	.	.	.	.	.	.	.	.	.	.	.	.	X
6 RIVAD/ISORRPIA	X	X	X	X	X	X	.	.	X	X	.	.	.	.
7 RIVAD/ISORRPIA/SOA	X	X	X	X	X	X	.	.	X	X	X	X	.	.

Ozone data input option (MOZ) Default: 1 ! MOZ = 1 !
 (Used only if MCHEM = 1, 3, 4, 6, or 7)
 0 = use a monthly background ozone value
 1 = read hourly ozone concentrations from the OZONE.DAT data file

Monthly ozone concentrations in ppb (BCKO3)
 (Used only if MCHEM = 1,3,4,6, or 7 and either
 MOZ = 0, or
 MOZ = 1 and all hourly O3 data missing)
 Default: 12*80.
 ! BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00,
 80.00, 80.00, 80.00 !

Ammonia data option (MNH3) Default: 0 ! MNH3 = 0 !
 (Used only if MCHEM = 6 or 7)
 0 = use monthly background ammonia values (BCKNH3) - no vertical
 variation
 1 = read monthly background ammonia values for each layer from the NH3Z.DAT data file

Ammonia vertical averaging option (MAVGNH3)
 (Used only if MCHEM = 6 or 7, and MNH3 = 1)
 0 = use NH3 at puff center height (no averaging is done)
 1 = average NH3 values over vertical extent of puff
 Default: 1 ! MAVGNH3 = 1 !

Monthly ammonia concentrations in ppb (BCKNH3)
 (Used only if MCHEM = 1 or 3, or
 if MCHEM = 6 or 7, and MNH3 = 0)
 Default: 12*10.
 ! BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00,
 10.00, 10.00, 10.00 !

Nighttime SO2 loss rate in %/hour (RNITE1)
 (Used only if MCHEM = 1, 6 or 7)
 This rate is used only at night for MCHEM=1
 and is added to the computed rate both day
 and night for MCHEM=6,7 (heterogeneous reactions)
 Default: 0.2 ! RNITE1 = .2 !

Nighttime NOx loss rate in %/hour (RNITE2)
 (Used only if MCHEM = 1)
 Default: 2.0 ! RNITE2 = 2.0 !

Nighttime HNO3 formation rate in %/hour (RNITE3)
 (Used only if MCHEM = 1)
 Default: 2.0 ! RNITE3 = 2.0 !

H2O2 data input option (MH2O2) Default: 1 ! MH2O2 = 1 !
 (Used only if MCHEM = 6 or 7, and MAQCHEM = 1)
 0 = use a monthly background H2O2 value
 1 = read hourly H2O2 concentrations from

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the H2O2.DAT data file

Monthly H2O2 concentrations in ppb (BCKH2O2)

(Used only if MQACHEM = 1 and either

MH2O2 = 0 or

MH2O2 = 1 and all hourly H2O2 data missing)

Default: 12*1.

! BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00, 1.00 !

--- Data for SECONDARY ORGANIC AEROSOL (SOA) Options
(used only if MCHEM = 4 or 7)

The MCHEM = 4 SOA module uses monthly values of:

Fine particulate concentration in ug/m³ (BCKPMF)

Organic fraction of fine particulate (OFRAC)

VOC / NOX ratio (after reaction) (VCNX)

The MCHEM = 7 SOA module uses monthly values of:

Fine particulate concentration in ug/m³ (BCKPMF)

Organic fraction of fine particulate (OFRAC)

These characterize the air mass when computing
the formation of SOA from VOC emissions.

Typical values for several distinct air mass types are:

Month	1	2	3	4	5	6	7	8	9	10	11	12
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Clean Continental												
BCKPMF	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
OFRAC	.15	.15	.20	.20	.20	.20	.20	.20	.20	.20	.20	.15
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Clean Marine (surface)												
BCKPMF	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5	.5
OFRAC	.25	.25	.30	.30	.30	.30	.30	.30	.30	.30	.30	.25
VCNX	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.	50.
Urban - low biogenic (controls present)												
BCKPMF	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.	30.
OFRAC	.20	.20	.25	.25	.25	.25	.25	.25	.20	.20	.20	.20
VCNX	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
Urban - high biogenic (controls present)												
BCKPMF	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.	60.
OFRAC	.25	.25	.30	.30	.30	.55	.55	.55	.35	.35	.35	.25
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Regional Plume												
BCKPMF	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.	20.
OFRAC	.20	.20	.25	.35	.25	.40	.40	.40	.30	.30	.30	.20
VCNX	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.	15.
Urban - no controls present												
BCKPMF	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.	100.
OFRAC	.30	.30	.35	.35	.35	.55	.55	.55	.35	.35	.35	.30
VCNX	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.	2.

Default: Clean Continental

! BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00, 1.00 !

! OFRAC = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20,
0.20, 0.15 !

! VCNX = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00 !

--- End Data for SECONDARY ORGANIC AEROSOL (SOA) Option

Number of half-life decay specification blocks provided in Subgroup 11b
(Used only if MCHEM = 5)
(NDECAY) Default: 0 ! NDECAY = 0

!

!END!

----- Subgroup (11b) -----

Each species modeled may be assigned a decay half-life (sec), and the associated mass lost may be assigned to one or more other modeled species using a mass yield factor. This information is used only for MCHEM=5.

Provide NDECAY blocks assigning the half-life for a parent species and mass yield factors for each child species (if any) produced by the decay.
Set HALF_LIFE=0.0 for NO decay (infinite half-life).

	SPECIES NAME		Half-Life ^a (sec)	Mass Yield ^b Factor		
	-----		-----	-----		
*	SPEC1	=	3600.,	-1.0	*	(Parent)
*	SPEC2	=	-1.0,	0.0	*	(Child)
END						

a
Specify a half life that is greater than or equal to zero for 1 parent species in each block, and set the yield factor for this species to -1
b
Specify a yield factor that is greater than or equal to zero for 1 or more child species in each block, and set the half-life for each of these species to -1

NOTE: Assignments in each block are treated as a separate input subgroup and therefore must end with an input group terminator.
If NDECAY=0, no assignments and input group terminators should appear.

----- INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters -----

Horizontal size of puff (m) beyond which time-dependent dispersion equations (Heffter) are used to determine sigma-y and sigma-z (SYTDEP) Default: 550. ! SYTDEP = 5.5E02 !

Switch for using Heffter equation for sigma z as above (0 = Not use Heffter; 1 = use Heffter (MHFTSZ) Default: 0 ! MHFTSZ = 0
!

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Stability class used to determine plume growth rates for puffs above the boundary layer (JSUP)

Default: 5 ! JSUP = 5 !

Vertical dispersion constant for stable conditions (k1 in Eqn. 2.7-3) (CONK1)

Default: 0.01 ! CONK1 = .01 !

Vertical dispersion constant for neutral/unstable conditions (k2 in Eqn. 2.7-4) (CONK2)

Default: 0.1 ! CONK2 = .1 !

Factor for determining Transition-point from Schulman-Scire to Huber-Snyder Building Downwash scheme (SS used for $H_s < H_b + TBD * HL$) (TBD)

Default: 0.5 ! TBD = .5 !

TBD < 0 ==> always use Huber-Snyder
TBD = 1.5 ==> always use Schulman-Scire
TBD = 0.5 ==> ISC Transition-point

Range of land use categories for which urban dispersion is assumed (IURB1, IURB2)

Default: 10 ! IURB1 = 10 !
19 ! IURB2 = 19 !

Site characterization parameters for single-point Met data files -----
(needed for METFM = 2,3,4,5)

Land use category for modeling domain (ILANDUIN)

Default: 20 ! ILANDUIN = 20

!

Roughness length (m) for modeling domain (Z0IN)

Default: 0.25 ! Z0IN = .25 !

Leaf area index for modeling domain (XLAIIN)

Default: 3.0 ! XLAIIN = 3.0 !

Elevation above sea level (m) (ELEVIN)

Default: 0.0 ! ELEVIN = .0 !

Latitude (degrees) for met location (XLATIN)

Default: -999. ! XLATIN = -999.

!

Longitude (degrees) for met location (XLONIN)

Default: -999. ! XLONIN = -999.

!

Specialized information for interpreting single-point Met data files -----

Anemometer height (m) (Used only if METFM = 2,3) (ANEMHT)

Default: 10. ! ANEMHT = 10.0

!

Form of lateral turbulence data in PROFILE.DAT file
(Used only if METFM = 4,5 or MTURBVW = 1 or 3) (ISIGMAV)

Default: 1 ! ISIGMAV = 1

!

0 = read sigma-theta
1 = read sigma-v

Choice of mixing heights (Used only if METFM = 4) (IMIXCTDM)

Default: 0 ! IMIXCTDM = 0

!

0 = read PREDICTED mixing heights
1 = read OBSERVED mixing heights

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Maximum length of a slug (met. grid units)
(MXLEN) Default: 1.0 ! MXLEN = 1.0 !

Maximum travel distance of a puff/slug (in
grid units) during one sampling step
(XSAMLEN) Default: 1.0 ! XSAMLEN = 1.0

Maximum Number of slugs/puffs release from
one source during one time step
(MXNEW) Default: 99 ! MXNEW = 99

Maximum Number of sampling steps for
one puff/slug during one time step
(MXSAM) Default: 99 ! MXSAM = 99

Number of iterations used when computing
the transport wind for a sampling step
that includes gradual rise (for CALMET
and PROFILE winds)
(NCOUNT) Default: 2 ! NCOUNT = 2

Minimum sigma y for a new puff/slug (m)
(SYMIN) Default: 1.0 ! SYMIN = 1.0 !

Minimum sigma z for a new puff/slug (m)
(SZMIN) Default: 1.0 ! SZMIN = 1.0 !

Maximum sigma z (m) allowed to avoid
numerical problem in calculating virtual
time or distance. Cap should be large
enough to have no influence on normal events.
Enter a negative cap to disable.
(SZCAP_M) Default: 5.0e06 ! SZCAP_M =

5.0E06 !

Default minimum turbulence velocities sigma-v and sigma-w
for each stability class over land and over water (m/s)
(SVMIN(12) and SWMIN(12))

----- LAND -----						----- WATER -----					
Stab Class :	A	B	C	D	E	F	A	B	C	D	E
F	---	---	---	---	---	---	---	---	---	---	---
Default SVMIN :	.50,	.50,	.50,	.50,	.50,	.50,	.37,	.37,	.37,	.37,	.37,
Default SWMIN :	.20,	.12,	.08,	.06,	.03,	.016,	.20,	.12,	.08,	.06,	.03,

! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370, 0.370,
0.370, 0.370, 0.370, 0.370!

! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200, 0.120,
0.080, 0.060, 0.030, 0.016!

Divergence criterion for dw/dz across puff
used to initiate adjustment for horizontal
convergence (1/s)
Partial adjustment starts at CDIV(1), and
full adjustment is reached at CDIV(2)
(CDIV(2)) Default: 0.0,0.0 ! CDIV = .0,

.0 !

Search radius (number of cells) for nearest

land and water cells used in the subgrid

TIBL module

(NLUTIBL)

Default: 4

! NLUTIBL = 4

!

Minimum wind speed (m/s) allowed for
non-calm conditions. Also used as minimum
speed returned when using power-law
extrapolation toward surface
(WSCALM)

Default: 0.5

! WSCALM = .5 !

Maximum mixing height (m)
(XMAXZI)

Default: 3000.

! XMAXZI =

3000.0 !

Minimum mixing height (m)
(XMINZI)

Default: 50.

! XMINZI = 20.0

!

Default wind speed classes --
5 upper bounds (m/s) are entered;
the 6th class has no upper limit
(WSCAT(5))

Default :

ISC RURAL : 1.54, 3.09, 5.14, 8.23, 10.8

(10.8+)

Wind Speed Class : 1 2 3 4 5

! WSCAT = 1.54, 3.09, 5.14, 8.23, 10.80 !

Default wind speed profile power-law
exponents for stabilities 1-6
(PLX0(6))

Default : ISC RURAL values

ISC RURAL : .07, .07, .10, .15, .35, .55

ISC URBAN : .15, .15, .20, .25, .30, .30

Stability Class : A B C D E

F

! PLX0 = 0.07, 0.07, 0.10, 0.15, 0.35,

0.55 !

Default potential temperature gradient
for stable classes E, F (degK/m)
(PTG0(2))

Default: 0.020, 0.035

! PTG0 = 0.020, 0.035 !

Default plume path coefficients for
each stability class (used when option
for partial plume height terrain adjustment
is selected -- MCTADJ=3)
(PPC(6))

Stability Class : A B C D E

F

Default PPC : .50, .50, .50, .50, .35,

.35

! PPC = 0.50, 0.50, 0.50, 0.50, 0.35,

0.35 !

Slug-to-puff transition criterion factor
equal to sigma-y/length of slug
(SL2PF)

Default: 10.

! SL2PF = 10.0 !

Puff-splitting control variables -----

VERTICAL SPLIT

(NSPLIT)

0=do not re-split 1=eligible for re-split

(IRESPLIT(24))

```
! IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !
```

(ZISPLIT)

!

(ROLDMAX)

!

(NSPLITH)

(SYSPLITH)

!

(SHSPLITH)

!

(CNSPLITH)

1.0E-07 !

(EPSSLUG)

1.0E-04 !

(EPSAREA)

1.0E-06 !

(DSRISE)

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Boundary Condition (BC) Puff control variables -----

Minimum height (m) to which BC puffs are mixed as they are emitted
(MBCON=2 ONLY). Actual height is reset to the current mixing height
at the release point if greater than this minimum.

(HTMINBC) Default: 500. ! HTMINBC = 500.0

!

Search radius (km) about a receptor for sampling nearest BC puff.
BC puffs are typically emitted with a spacing of one grid cell
length, so the search radius should be greater than DGRIDKM.

(RSAMPBC) Default: 10. ! RSAMPBC = 10.0

!

Near-Surface depletion adjustment to concentration profile used when
sampling BC puffs?

(MDEPBC) Default: 1 ! MDEPBC = 1 !

0 = Concentration is NOT adjusted for depletion

1 = Adjust Concentration for depletion

!END!

INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters

Subgroup (13a)

Number of point sources with
parameters provided below

(NPT1) No default ! NPT1 = 0 !

Units used for point source
emissions below

(IPTU) Default: 1 ! IPTU = 1 !

1 = g/s

2 = kg/hr

3 = lb/hr

4 = tons/yr

5 = Odour Unit * m**3/s (vol. flux of odour compound)

6 = Odour Unit * m**3/min

7 = metric tons/yr

8 = Bq/s (Bq = becquerel = disintegrations/s)

9 = GBq/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (13d)

(NSPT1) Default: 0 ! NSPT1 = 0 !

Number of point sources with
variable emission parameters
provided in external file

(NPT2) No default ! NPT2 = 0 !

(If NPT2 > 0, these point
source emissions are read from
the file: PTEMARB.DAT)

!END!

Subgroup (13b)

a

Anna_Bay_Quarry_calpuff_FEL.inp
POINT SOURCE: CONSTANT DATA

Source Emission No. Rates	X	Y	Stack	Base	Stack	Exit	Exit	Bldg.
	Coordinate (km)	Coordinate (km)	Height (m)	Elevation (m)	Diameter (m)	Vel. (m/s)	Temp. (deg. K)	Dwash
-----	-----	-----	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----	-----
-----	-----	-----	-----	-----	-----	-----	-----	-----

a

Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)

X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)

b

0. = No building downwash modeled
1. = Downwash modeled for buildings resting on the surface
2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)
NOTE: must be entered as a REAL number (i.e., with decimal point)

c

An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IPTU (e.g. 1 for g/s).

Subgroup (13c)

Subgroup (13c)

BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH

No.	Source(a)
-----	Effective building height, width, length and X/Y offset (in meters) every 10 degrees. LENGTH, XBADJ, and YBADJ are only needed for MBDW=2 (PRIME downwash option)
-----	-----
-----	-----

a

Building height, width, length, and X/Y offset from the source are treated as a separate input subgroup for each source and therefore must end with an input group terminator. The X/Y offset is the position, relative to the stack, of the center of the upwind face of the projected building, with the x-axis pointing along the flow direction.

Subgroup (13d)

a
POINT SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission rates given in 13b. Factors entered multiply the rates in 13b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12
- 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

a

Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters

Subgroup (14a)

Number of polygon area sources with

Anna_Bay_Quarry_calpuff_FEL.inp

parameters specified below (NAR1) No default ! NAR1 = 0 !

Units used for area source
emissions below (IARU) Default: 1 ! IARU = 1 !

1 = g/m**2/s
2 = kg/m**2/hr
3 = lb/m**2/hr
4 = tons/m**2/yr
5 = Odour Unit * m/s (vol. flux/m**2 of odour compound)
6 = Odour Unit * m/min
7 = metric tons/m**2/yr
8 = Bq/m**2/s (Bq = becquerel = disintegrations/s)
9 = GBq/m**2/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (14d) (NSAR1) Default: 0 ! NSAR1 = 0 !

Number of buoyant polygon area sources
with variable location and emission
parameters (NAR2) No default ! NAR2 = 0 !
(If NAR2 > 0, ALL parameter data for
these sources are read from the file: BAEMARB.DAT)

!END!

Subgroup (14b)

a
AREA SOURCE: CONSTANT DATA

Source No.	Effect. Height (m)	Base Elevation (m)	Initial Sigma z (m)	Emission Rates
-----	-----	-----	-----	-----

-
- a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.
- b
An emission rate must be entered for every pollutant modeled.
Enter emission rate of zero for secondary pollutants that are
modeled, but not emitted. Units are specified by IARU
(e.g. 1 for g/m**2/s).

Subgroup (14c)

COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON

Source No.	Ordered list of X followed by list of Y, grouped by source
-----	-----

-
- a
Data for each source are treated as a separate input subgroup
and therefore must end with an input group terminator.

Subgroup (14d)

AREA SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission rates given in 14b. Factors entered multiply the rates in 14b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

IVARY determines the type of variation, and is source-specific:

(IVARY)

Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12)
- 5 = Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

a

Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters

Subgroup (15a)

Number of buoyant line sources with variable location and emission parameters (NLN2)

No default ! NLN2 = 0 !

(If NLN2 > 0, ALL parameter data for these sources are read from the file: LNEARB.DAT)

Number of buoyant line sources (NLINES)

No default ! NLINES = 0 !

Units used for line source emissions below

(ILNU)

Default: 1 ! ILNU = 1 !

- 1 = g/s
- 2 = kg/hr
- 3 = lb/hr
- 4 = tons/yr
- 5 = Odour Unit * m**3/s (vol. flux of odour compound)
- 6 = Odour Unit * m**3/min
- 7 = metric tons/yr
- 8 = Bq/s (Bq = becquerel = disintegrations/s)
- 9 = GBq/yr

Number of source-species combinations with variable emissions scaling factors provided below in (15c)

(NSLN1) Default: 0 ! NSLN1 = 0 !

Anna_Bay_Quarry_calpuff_FEL.inp

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

- 0 = Constant
- 1 = Diurnal cycle (24 scaling factors: hours 1-24)
- 2 = Monthly cycle (12 scaling factors: months 1-12)
- 3 = Hour & Season (4 groups of 24 hourly scaling factors,
where first group is DEC-JAN-FEB)
- 4 = Speed & Stab. (6 groups of 6 scaling factors, where
first group is Stability Class A,
and the speed classes have upper
bounds (m/s) defined in Group 12
- 5 = Temperature (12 scaling factors, where temperature
classes have upper bounds (C) of:
0, 5, 10, 15, 20, 25, 30, 35, 40,
45, 50, 50+)

a
Data for each species are treated as a separate input subgroup
and therefore must end with an input group terminator.

INPUT GROUPS: 16a, 16b, 16c -- volume source parameters

Subgroup (16a)

Number of volume sources with
parameters provided in 16b,c (NVL1) No default ! NVL1 = 0 !

Units used for volume source
emissions below in 16b (IVLU) Default: 1 ! IVLU = 1 !

- 1 = g/s
- 2 = kg/hr
- 3 = lb/hr
- 4 = tons/yr
- 5 = Odour Unit * m**3/s (vol. flux of odour compound)
- 6 = Odour Unit * m**3/min
- 7 = metric tons/yr
- 8 = Bq/s (Bq = becquerel = disintegrations/s)
- 9 = GBq/yr

Number of source-species
combinations with variable
emissions scaling factors
provided below in (16c) (NSVL1) Default: 0 ! NSVL1 = 0 !

Number of volume sources with
variable location and emission
parameters (NVL2) No default ! NVL2 = 2 !

(If NVL2 > 0, ALL parameter data for
these sources are read from the VOLEMARB.DAT file(s))

!END!

Subgroup (16b)

a

Anna_Bay_Quarry_calpuff_FEL.inp
VOLUME SOURCE: CONSTANT DATA

X Coordinate (km)	Y Coordinate (km)	Effect. Height (m)	Base Elevation (m)	Initial Sigma y (m)	Initial Sigma z (m)	Emission Rates
-------------------------	-------------------------	--------------------------	--------------------------	---------------------------	---------------------------	-------------------

a
Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

b
An emission rate must be entered for every pollutant modeled. Enter emission rate of zero for secondary pollutants that are modeled, but not emitted. Units are specified by IVLU (e.g. 1 for g/s).

Subgroup (16c)

VOLUME SOURCE: VARIABLE EMISSIONS DATA

Use this subgroup to describe temporal variations in the emission rates given in 16b. Factors entered multiply the rates in 16b. Skip sources here that have constant emissions. For more elaborate variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

IVARY determines the type of variation, and is source-specific:
(IVARY) Default: 0

0 =	Constant
1 =	Diurnal cycle (24 scaling factors: hours 1-24)
2 =	Monthly cycle (12 scaling factors: months 1-12)
3 =	Hour & Season (4 groups of 24 hourly scaling factors, where first group is DEC-JAN-FEB)
4 =	Speed & Stab. (6 groups of 6 scaling factors, where first group is Stability Class A, and the speed classes have upper bounds (m/s) defined in Group 12)
5 =	Temperature (12 scaling factors, where temperature classes have upper bounds (C) of: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 50+)

a
Data for each species are treated as a separate input subgroup and therefore must end with an input group terminator.

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information

Subgroup (17a)

Number of non-gridded receptors (NREC) No default ! NREC = 4253 !

!END!

Subgroup (17b)

a
NON-GRIDDED (DISCRETE) RECEPTOR DATA

Receptor No.		X Coordinate (km)	Y Coordinate (km)	Ground Elevation (m)	Height Above Ground (m)
1	! X =	410.16	6375.175	1,0!	!END!
2	! X =	410.207	6375.176	0,0!	!END!
3	! X =	410.254	6375.176	1,0!	!END!
4	! X =	410.3	6375.177	2,0!	!END!
5	! X =	410.347	6375.177	2,0!	!END!
6	! X =	410.394	6375.178	2,0!	!END!
7	! X =	410.441	6375.178	2,0!	!END!
8	! X =	410.488	6375.178	2,0!	!END!
9	! X =	410.535	6375.179	2,0!	!END!
10	! X =	410.582	6375.179	2,0!	!END!
11	! X =	410.628	6375.18	2,0!	!END!
12	! X =	410.675	6375.18	2,0!	!END!
13	! X =	410.722	6375.181	1,0!	!END!
14	! X =	410.769	6375.181	0,0!	!END!
15	! X =	410.816	6375.181	0,0!	!END!
16	! X =	410.863	6375.182	1,0!	!END!
17	! X =	410.909	6375.182	1,0!	!END!
18	! X =	410.956	6375.183	2,0!	!END!
19	! X =	411.003	6375.183	3,0!	!END!
20	! X =	411.05	6375.183	3,0!	!END!
21	! X =	411.097	6375.184	3,0!	!END!
22	! X =	411.144	6375.184	2,0!	!END!
23	! X =	411.19	6375.185	2,0!	!END!
24	! X =	411.237	6375.185	2,0!	!END!
25	! X =	411.284	6375.186	2,0!	!END!
26	! X =	411.331	6375.186	2,0!	!END!
27	! X =	411.378	6375.186	2,0!	!END!
28	! X =	411.425	6375.187	2,0!	!END!
29	! X =	411.471	6375.187	1,0!	!END!
30	! X =	411.518	6375.188	2,0!	!END!
31	! X =	411.565	6375.188	2,0!	!END!
32	! X =	411.612	6375.189	2,0!	!END!
33	! X =	411.659	6375.189	2,0!	!END!
34	! X =	411.706	6375.189	2,0!	!END!
35	! X =	411.752	6375.19	3,0!	!END!
36	! X =	411.799	6375.19	2,0!	!END!
37	! X =	411.846	6375.191	-1,0!	!END!
38	! X =	411.893	6375.191	3,0!	!END!
39	! X =	411.94	6375.191	3,0!	!END!
40	! X =	411.987	6375.192	3,0!	!END!
41	! X =	412.033	6375.192	3,0!	!END!
42	! X =	412.08	6375.193	2,0!	!END!
43	! X =	412.127	6375.193	2,0!	!END!
44	! X =	412.174	6375.194	2,0!	!END!
45	! X =	412.221	6375.194	2,0!	!END!
46	! X =	412.268	6375.194	2,0!	!END!
47	! X =	412.315	6375.195	2,0!	!END!
48	! X =	412.361	6375.195	2,0!	!END!
49	! X =	412.408	6375.196	2,0!	!END!
50	! X =	412.455	6375.196	2,0!	!END!
51	! X =	412.502	6375.196	3,0!	!END!
52	! X =	412.549	6375.197	3,0!	!END!
53	! X =	412.596	6375.197	3,0!	!END!
54	! X =	412.642	6375.198	4,0!	!END!
55	! X =	412.689	6375.198	4,0!	!END!
56	! X =	412.736	6375.198	5,0!	!END!
57	! X =	412.783	6375.199	6,0!	!END!

```

                                Anna_Bay_Quarry_calpuff_FEL.inp
4206 ! X =      412.293,6372.312,5,0!      !END!
4207 ! X =      412.34,6372.312,5,0!      !END!
4208 ! X =      412.387,6372.313,5,0!      !END!
4209 ! X =      412.434,6372.313,5,0!      !END!
4210 ! X =      412.48,6372.314,5,0!      !END!
4211 ! X =      412.527,6372.314,5,0!      !END!
4212 ! X =      412.574,6372.314,5,0!      !END!
4213 ! X =      412.621,6372.315,5,0!      !END!
4214 ! X =      412.668,6372.315,5,0!      !END!
4215 ! X =      412.715,6372.316,5,0!      !END!
4216 ! X =      412.761,6372.316,5,0!      !END!
4217 ! X =      412.808,6372.316,4,0!      !END!
4218 ! X =      412.855,6372.317,4,0!      !END!
4219 ! X =      412.902,6372.317,5,0!      !END!
4220 ! X =      412.949,6372.318,4,0!      !END!
4221 ! X =      412.996,6372.318,4,0!      !END!
4222 ! X =      413.37,6372.321,6,0!      !END!
4223 ! X =      413.417,6372.322,6,0!      !END!
4224 ! X =      413.464,6372.322,6,0!      !END!
4225 ! X =      413.511,6372.323,6,0!      !END!
4226 ! X =      413.557,6372.323,6,0!      !END!
4227 ! X =      413.604,6372.323,6,0!      !END!
4228 ! X =      413.651,6372.324,6,0!      !END!
4229 ! X =      413.698,6372.324,6,0!      !END!
4230 ! X =      413.745,6372.325,7,0!      !END!
4231 ! X =      413.792,6372.325,8,0!      !END!
4232 ! X =      413.838,6372.325,9,0!      !END!
4233 ! X =      413.885,6372.326,9,0!      !END!
4234 ! X =      412.483,6373.71,12,1.5!      !END!
4235 ! X =      412.293,6373.789,12,1.5!      !END!
4236 ! X =      411.678,6374.047,5,1.5!      !END!
4237 ! X =      412.528,6373.787,11,1.5!      !END!
4238 ! X =      412.446,6373.571,11,1.5!      !END!
4239 ! X =      411.695,6374.079,4,1.5!      !END!
4240 ! X =      411.864,6373.931,7,1.5!      !END!
4241 ! X =      411.821,6374.16,3,1.5!      !END!
4242 ! X =      412.476,6373.565,11,1.5!      !END!
4243 ! X =      411.819,6374.165,3,1.5!      !END!
4244 ! X =      411.843,6373.871,9,1.5!      !END!
4245 ! X =      411.64,6374.071,4,1.5!      !END!
4246 ! X =      411.879,6374.037,5,1.5!      !END!
4247 ! X =      412.432,6373.552,11,1.5!      !END!
4248 ! X =      411.888,6373.948,6,1.5!      !END!
4249 ! X =      411.846,6373.963,7,1.5!      !END!
4250 ! X =      412.143,6373.863,10,1.5!      !END!
4251 ! X =      411.924,6374.02,4,1.5!      !END!
4252 ! X =      411.822,6374.04,5,1.5!      !END!
4253 ! X =      411.851,6373.881,9,1.5!      !END!
-----

```

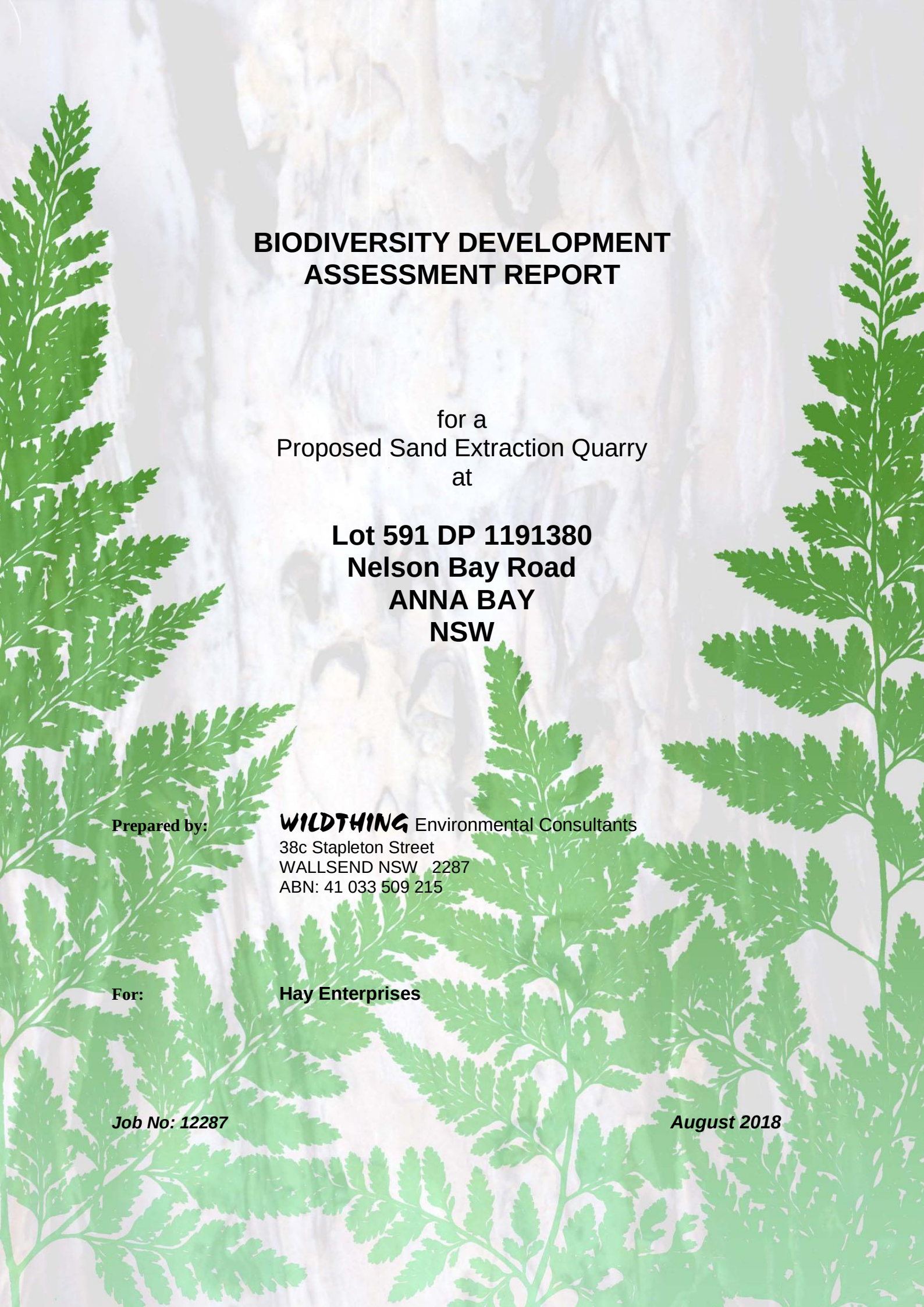
a

Data for each receptor are treated as a separate input subgroup and therefore must end with an input group terminator.

b

Receptor height above ground is optional. If no value is entered, the receptor is placed on the ground.

Appendix D: Biodiversity Assessment



BIODIVERSITY DEVELOPMENT ASSESSMENT REPORT

for a
Proposed Sand Extraction Quarry
at

**Lot 591 DP 1191380
Nelson Bay Road
ANNA BAY
NSW**

Prepared by:

WILDTHING Environmental Consultants
38c Stapleton Street
WALLSEND NSW 2287
ABN: 41 033 509 215

For:

Hay Enterprises

Job No: 12287

August 2018

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Project Name	Biodiversity Development Assessment Report for a proposed sand extraction quarry within Lot 591 DP 1191380 Nelson Bay Road, Bobs Farm NSW	
Project Number	12287	
Prepared By	Ben Ellis Ecologist	
	Daryl Harman Senior Ecologist BEnvSc	
	Dr Kylie Bridges BEnvSc Hons PhD	
Reviewed By	Daryl Harman Senior Ecologist	
Status	Final - August 2018	
Version Number	1	

Disclaimer

This report has been prepared in accordance with the proposal provided by the Client and outlined within this report. All findings, conclusions or recommendations contained within this report are based upon the data and results collected under the times and conditions specified in the report and are only applicable for the proposal considered within this report. This report has been prepared for use exclusively by the Client. No responsibility for its use by any other party is accepted by WILDTHING Environmental Consultants.

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INTRODUCTION

This Biodiversity Development Assessment Report (BDAR) has been prepared for Hay Enterprises to inform the preparation of an Environmental Impact Statement (EIS) for a proposed sand extraction quarry within Lot 591 DP 1191380 Nelson Bay Road, Anna Bay NSW (the study area).

1.1 OBJECTIVE

This BDAR has been prepared in accordance with the Biodiversity Assessment Methodology (BAM) (OEH 2017) by Wildthing Environmental Consultants on behalf of Hay Enterprises. The objective of this BDAR is to address the requirements of the Secretary's Environmental Assessment Requirements (SEARs) listed below which relate specifically to the proposed development of the land, the subject of the EIS:

The EIS must assess the potential impacts of the proposal at all stages of the development, including the establishment, operation and decommissioning of the development. SEARs specify that the EIS must address the following biodiversity specific issues:

- *accurate predictions of any vegetation clearing on site;*
- *a detailed assessment of the potential biodiversity impacts of the development in accordance with the Biodiversity Assessment Method (BAM), paying particular attention to threatened species, populations and ecological communities and groundwater dependent ecosystems;*
- *a detailed description of the proposed measures to maintain or improve the biodiversity values of the site in the medium to long term, as relevant;*
- *an assessment of whether a Species Impact Statement is required; and*
- *consideration of weed management.*

No additional or specific threatened species, populations or communities (hereafter collectively referred to as threatened matters) were specified in the SEARs or by the NSW Office of Environment and Heritage (OEH) for consideration.

In addition, this BDAR will:

- identify how the proponent proposes to avoid and minimise impacts to biodiversity
- identify any potential impact that could be characterised as serious and irreversible
- describe the offset obligations required to compensate for any residual biodiversity impacts resulting from the proposed development in accordance with the Biodiversity Offsets Scheme (BOS)

All biodiversity assessments have been undertaken in accordance with the BAM, and this BDAR has been prepared by Accredited Assessor Ben Ellis (BAAS18078) and reviewed by Accredited Assessor Daryl Harman (BAAS17074).

1.2 DESCRIPTION OF THE DEVELOPMENT FOOTPRINT

The proposed sand extraction quarry will require the installation of several minor project components during its construction stage, which are:

- A minor realignment of a pre-existing access track running north through the study area to allow for the movement of reticulated vehicles accessing the sand dunes of Stockton Bight from Nelson Bay Road
- The construction of a site managers shed with a development footprint of approximately 800m²
- The establishment of a bushfire asset protection zone with a radius of approximately 35m from the edge of the site managers shed.

Operational effects of the sand extraction process will be restricted to the bulk handling of sand material, utilising front end loaders and reticulated vehicles for the transport of the material to the required markets. Initially the extraction of sand will be restricted to the area of Stockton Sand Dunes that has encroached into the study area (approximately 1 ha). It is anticipated, based upon previous observations made by the proponent, that the sand dune incursion within the study area will advance over time allowing for more sand material extent to be extracted. The operation will provide up to 50,000 cubic metres of quarried material per annum. The development is proposed to operate between the hours of 7:00 am and 6:00 pm Monday to Friday and between 8:00 am to 1:00 pm on Saturdays. No work is proposed on Sundays or on Public Holidays.

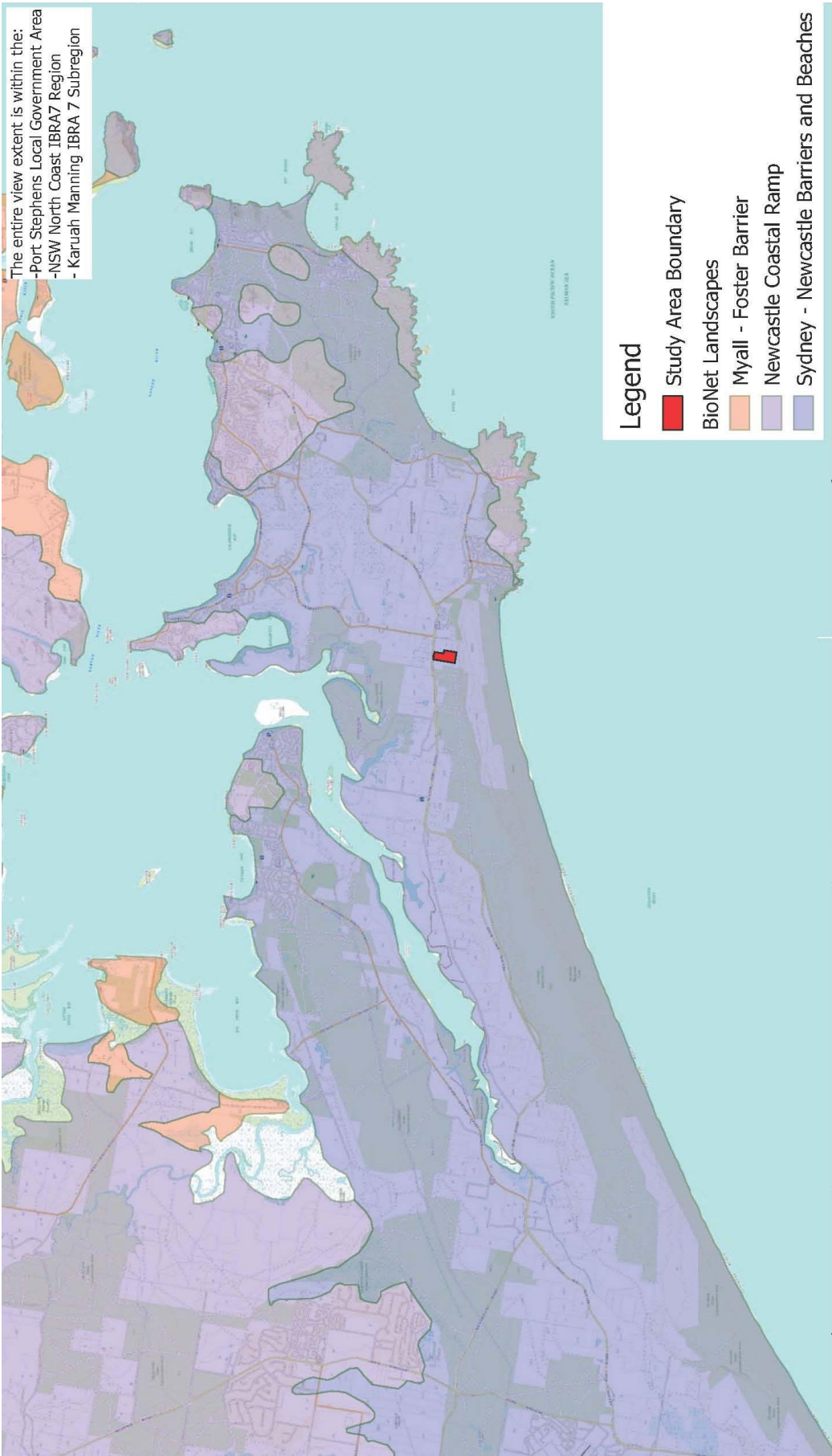
The above project components and operational effects of the proposed sand extraction quarry are hereafter collectively referred to as the proposed development. The proposed development layout is provided in Figure 1.1

1.3 DEFINITION OF THE STUDY AREA

The study area occurs on vegetated Aeolian Holocene transgressive dunes and the majority of the study area consisted of dry open sclerophyll forest dominated by the canopy species *Eucalyptus pilularis* (Blackbutt) and *Angophora costata* (Smooth-barked Apple). The majority of this community was in moderate condition, however the northern portion of this community had been exposed to recent disturbance in the form of underscrubbing which has modified the midstorey and understorey layers and removed a number of less mature canopy trees. A small area in the north west of the study area was composed of cleared grassland and a shed. A grassy electrical easement ran through the southern portion of the study area. Two access tracks ran north-south through the study area.

Location

The 13.66 ha study area (Lot 591 DP 1191380) is located at Anna Bay, NSW, approximately 32km north-east of Newcastle and 9km south-west of Nelson Bay (Figure 1.2). The study area is situated on the southern side of Nelson Bay Road, bounded by the Stockton sand dunes to the south and predominantly bushland to the east and west.



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Study Area Location Map

Lot 591 DP 1191380
Anna Bay, NSW
19 June 2018

Figure 1.1

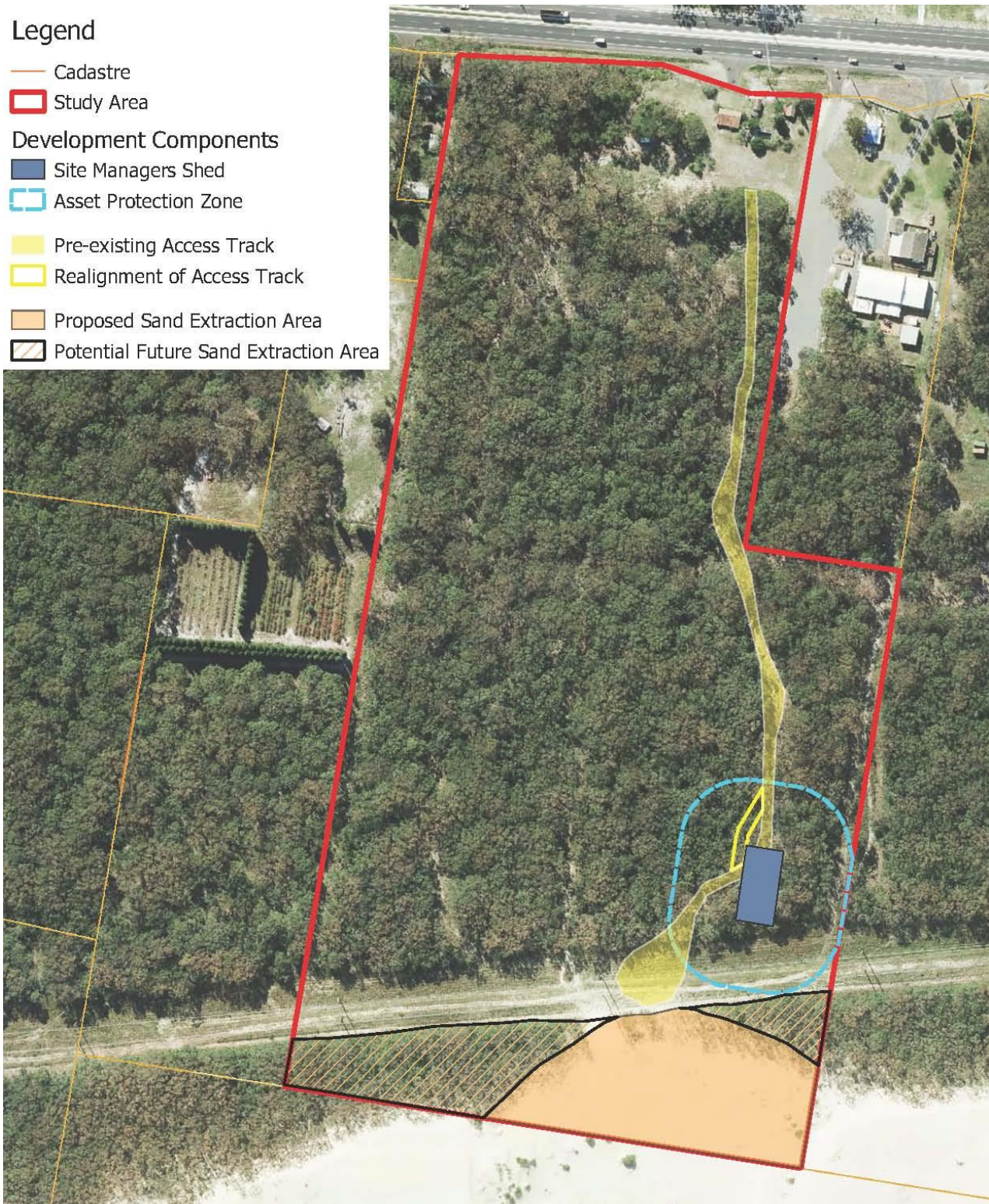
0 2.5 5 km

Map Projection GDA94 MGA Zone 56

Author	BE
Reviewer	DH
Job Ref	12287
A4 Scale	1:125,000

Legend

- Cadastre
- Study Area
- Development Components**
 - Site Managers Shed
 - Asset Protection Zone
 - Pre-existing Access Track
 - Realignment of Access Track
 - Proposed Sand Extraction Area
 - Potential Future Sand Extraction Area



Author	BE	 0 50 100 m  Map Projection GDA94 MGA Zone 56	Figure 1.2
Reviewer	DH		Planning and Development Design Map
Job Ref	12287		Lot 591 DP 1191380 Anna Bay, NSW
A4 Scale	1:2,500		19 June 2018

Zoning of the study area

The study area is zoned RU2 Rural Landscape under the Port Stephens LEP (Port Stephens Council 2013). The objective of the RU2 Rural Landscape zone are:

- To encourage sustainable primary industry production by maintaining and enhancing the natural resource base;
- To maintain the rural landscape character of the land; and
- To provide for a range of compatible land uses, including extensive agriculture.

Land Tenure Information

The study area consists of a single parcel of land which is wholly owned by Ragusa Pty. Ltd.

1.4 INFORMATION SOURCES

A list of the resources used to inform this BDAR, the date they were accessed and the spatial extent captured, where relevant, is provided in Table 1.1.

Table 1.1: Desktop Resources

Resource	Date Reviewed	Spatial Extent
Previous Ecological Studies		
Wildthing Environmental Consultants (2017) Proposed Sand Extraction Quarry at Lot 591 DP 1191380 Nelson Bay Road, Anna Bay NSW Flora and Fauna Assessment Report. (Unpublished).	25-27 May 2018	-
ERM (2003). Environmental Impact Statement for the Electricity Supply Upgrade from Tomago to Tomaree. Energy Australia.	25-27 May 2018	-
Ecotone (2008) Vertebrate Fauna Survey Worimi Conservation Lands	25-27 May 2018	-
Department of Planning (2006) Lower Hunter Regional Strategy	25-27 May 2018	-
House (2003) Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy	25-27 May 2018	-
Bell & Driscoll (2010) Vegetation of the Worimi Conservation Lands Port Stephens, New South Wales: Worimi NP, Worimi SCA & Worimi RP	25-27 May 2018	-
Zoning and Regulatory Maps		
Port Stephens Local Environmental Plan - Land Zoning Map (LZN-004) (Port Stephens Council 2013)	25-27 May 2018	Entire study area
Biodiversity Values and Landscape Maps		
NSW Biodiversity Values Map (OEH 2018a)	25 May 2018	Entire study area
SIX Maps -Base Map - LPI 1:25,000 digital topographic databases (DTDB) (LPI 2018) -Cadastral data LPI digital cadastral database (DCDB) (LPI 2018)	25-27 May 2018	Entire study area
NSW SEED Mapping (NSW Gov 2018)	25-27 May 2018	Entire study area
BioNet NSW (Mitchell) Landscapes – Version 3.1 (OEH 2016a)	25-27 May 2018	Entire study area
NSW Interim Biogeographic Regions of Australia (IBRA region and sub-regions) – Version 7 (OEH 2016b)	25-27 May 2018	Entire study area

Atlas of Groundwater Dependent Ecosystems (BoM 2018)	25-27 May 2018	Entire study area
Soil Landscapes of the Port Stephens 1:100 000 Sheet Map. (Murphy 1995).	25-27 May 2018	Entire study area
Threatened Species, Vegetation and Landscape Databases		
BioNet Atlas of NSW Wildlife (BioNet) (OEH 2018b)	4 May 2018	10x10km radius of study area
Commonwealth Protected Matters Search Tool (PMST) (DoPE 2018a)	4 May 2018	10x10km radius of study area
Commonwealth species profiles and threats database (SPRAT) (DoPE 2018b)	May-June 2018	-
OEH Profiles of threatened species, population, and ecological communities (OEH 2018c)	May-June 2018	-
OEH BioNet Threatened Biodiversity Data Collection (TBDC) (OEH 2018d)	June 2018	-
OEH BioNet vegetation classification database (OEH 2018e)	11 May 2018	-
PlantNet NSW (The Royal Botanic Gardens and Domain Trust 2018).	May-June 2018	-
Directory of Important Wetlands in Australia (DIWA) (DoPE 2018c)	25-27 May 2018	-
Estuaries of NSW: Physical characteristics, tidal surveys and hydrographic surveys (OEH 2018e)	25-27 May 2018	-
Geological sites of NSW (Cartoscope 2018)	25-27 May 2018	-
OEH BioNet Vegetation Classification Database (VIS) (OEH 2018h)	25-27 May 2018	-
Survey and Reporting Methodology		
Biodiversity Assessment Method (BAM) (OEH 2017)	May-June 2018	-
Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018f)	May-June 2018	-
Threatened species survey and assessment guidelines: field survey methods for fauna – amphibians (OEH 2009)	May-June 2018	-
NSW Guide to Surveying Threatened Plants (OEH 2016)	May-June 2018	-
OEH Threatened Biodiversity Survey and Assessment Guidelines. Guidelines for Developments and Activities (OEH 2004)	May-June 2018	-
Biodiversity Assessment Method Credit Calculator (BAM-CC) (OEH, 2018g)	May-June 2018	-
Climactic Data		
061395 Tanilba Bay WWTP (BoM 2018)	25-27 May 2018	-
Development Footprint Design		
Anna Bay sand extraction quarry design and location map (Tattersall Lander 2018).	May-June	Entire development footprint

2.0 LEGISLATIVE CONTEXT

This chapter provides a brief outline of the key biodiversity legislation and government policy considered in this assessment.

2.1 COMMONWEALTH ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

The purpose of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is to ensure that actions likely to cause a significant impact on Matters of National Environmental Significance (MNES) undergo a process of assessment. Under the EPBC Act, an action includes a project, undertaking, development or activity that may impact MNES. An action that 'has, will have or is likely to have a significant impact on a MNES' is deemed to be a 'controlled action' and may not be undertaken without prior approval from the Commonwealth Minister for the Department of the Environment and Energy (DoEE). MNES categories listed under the EPBC Act are:

- world heritage properties;
- national heritage places;
- wetlands of international importance (Ramsar wetlands);
- threatened species and ecological communities (Section 18 and 18A);
- migratory species;
- commonwealth marine areas;
- nuclear actions (including uranium mining); and
- a water resource, in relation to coal seam gas development and large coal mining development.

Initially, MNES protected under the EPBC Act are assessed in accordance with the Significant Impact Guidelines 1.1 - Matters of National Environmental Significance (DoE 2013). This is performed to determine if there is likelihood for an action to have a significant impact on MNES. An action will require referral to, and may require the approval of, the Commonwealth Minister for the Environment (in addition to any local or state government consent or approval) if that action will have, or is likely to have, a significant impact on the environment or on a MNES.

The project is unlikely to have a significant impact on MNES and is, therefore, not required to be referred to DoEE for consideration. Further information on this matter is provided in Appendix A of this report.

2.2 NSW ENVIRONMENTAL PLANNING AND ASSESSMENT AMENDMENT ACT 2017

The *Environmental Planning & Assessment Act 1979* (EP&A Act) was legislated to require the consideration and management of impacts of proposed development and land use change on the environment and the community.

Part 1 Section 1.7 of the EP&A Act requires consideration of the proposed development under Part 7 of the Biodiversity Conservation Act 2016 (BC Act).

The EP&A Act is also supported by other statutory environmental planning instruments, including State Environmental Planning Policies (SEPPs). The following SEPPs are relevant to this report:

SEPP No. 44 Koala Habitat Protection

SEPP 44 aims to encourage the conservation and management of natural vegetation areas that provide habitat for koalas to ensure permanent free-living populations will be maintained over their present range and to reverse the current trend of koala-population decline. It applies to areas of native vegetation greater than one hectare and in Councils listed in Schedule 1 of SEPP 44. The study area is located in the Port Stephens LGA, as such the requirements of SEPP 44 are relevant to the assessment.

A Comprehensive Koala Plan of Management (CKPoM) was adopted by Port Stephens Council and ratified by the Department of Urban Affairs and Planning; taking effect from June 2002. The plan was prepared consistent with the requirements of SEPP44 for preparation of plans of management; its principal aims are consistent with that of SEPP 44. Compliance with the Port Stephens Council CKPoM constitutes compliance with SEPP 44 for relevant matters in the Port Stephens LGA (Port Stephens Council 2002).

Coastal Management SEPP

The State Environmental Planning Policy (Coastal Management) 2018 (CM SEPP) updates and consolidates into one integrated policy SEPP 14 (Coastal Wetlands), SEPP 26 (Littoral Rainforests) and SEPP 71 (Coastal Protection), including clause 5.5. of the Standard Instrument – Principal Local Environmental Plan. These policies are now repealed.

The aim of this Policy is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by:

- managing development in the coastal zone and protecting the environmental assets of the coast, and
- establishing a framework for land use planning to guide decision-making in the coastal zone, and
- mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

These coastal management areas are:

- the coastal wetlands and littoral rainforests area,
- the coastal vulnerability area,
- the coastal environment area, and

- the coastal use area.

The study area was not located within littoral rainforests/coastal wetlands, coastal vulnerability or coastal use management areas, however the study area is located within a mapped coastal environment area. Further information on this matter is provided in Appendix A of this report.

2.3 NSW BIODIVERSITY CONSERVATION ACT 2016

The BC Act and supporting regulations establish a modern and integrated legislative framework for land management and conservation in NSW. The purpose of the BC Act is *“to establish a pathway to avoid, minimise and offset the impacts of proposed development and land use change on biodiversity and to establish a scientific method for assessing the likely impacts on biodiversity values of proposed development and land use change, for calculating measures to offset those impacts and for assessing improvements in biodiversity values”*.

The assessment of development impacts on terrestrial biodiversity under Part 4 of the EP&A Act are now conducted in accordance with the criteria set-out in *Section 7.2* of the BC Act relating to whether a development or an activity is likely to *significantly affect threatened species*. As the SEARs for this project have requested a *detailed assessment of the potential biodiversity impacts of the development in accordance with the Biodiversity Assessment Method (BAM)*, this report has been prepared according to the methodology detailed within the BAM.

2.4 NSW BIOSECURITY ACT 2015

The NSW Biosecurity Act 2015 (BS Act), amongst other considerations, provides regulatory controls and powers to manage noxious weeds in NSW. For weed management, this Act divides NSW into regions based on combined LGAs and priority weeds for a region are listed. Some weeds are managed at a state level as they form part of a broader containment strategy. The legislation compliments listed Weeds of National Significance (WoNS). Ten priority weed species listed under the BS Act were identified within the study area. Further information on this matter is provided in Appendix A of this report.

2.5 PORT STEPHENS COMPREHENSIVE KOALA PLAN OF MANAGEMENT

The Port Stephens Council CKPoM has been prepared in accordance with State Environmental Planning Policy No. 44 - Koala Habitat Protection (SEPP 44). The principal aim of this CKPoM is identical to that of SEPP 44: *“...to encourage the proper conservation and management of areas of natural vegetation that provide habitat for koalas, to ensure permanent free-living populations over their present range and to reverse the current trend of population decline.”* The study area has been assessed to contain Supplementary Koala Habitat, as such an assessment of the proposal against the

performance criteria set out in the CKPoM has been undertaken. Further information on this matter is provided in Appendix A of this report.

2.6 LICENCING AND CERTIFICATES

Fieldwork undertaken by Wildthing Environmental Consultants was carried out under the NPWS Scientific Investigation Licence SL 100345 and under Animal Care and Ethics Approval: Animal Research Authority Issue by the Director General of NSW Agriculture (File No. TRIM 13/251) for the Fauna Survey for Biodiversity and Impact Assessment.

STAGE 1 - BIODIVERSITY ASSESSMENT

The proposed development is consistent with the definition of a site-based development under the Biodiversity Assessment Methodology. The proposed development is not eligible for the streamline assessment modules described in the BAM (OEH, 2017). The site-based development assessment methodology has been used to inform Stage 1 of this BAM assessment.

3.0 LANDSCAPE CONTEXT

This Section of the report describes the landscape context, including the landscape features present within the study area and a 1500 metre buffer from the edge of the study area (hereafter referred to as the locality), as required by the BAM (OEH 2017).

3.1 IBRA BIOREGION & SUBREGION

Interim Biogeographic Regionalisation for Australia (IBRA) Bioregions are large, geographically distinct areas of land with common characteristics such as geology, landform patterns, climate, ecological features, and flora and fauna communities. The study area is located within the NSW North Coast (NNC) IBRA Bioregion and the Karuah Manning IBRA Subregion (OEH 2016b). Both IBRA and IBRA Subregional Boundaries do not occur near the study area and hence are not shown within Figure 1.1.

3.2 NSW LANDSCAPE REGION

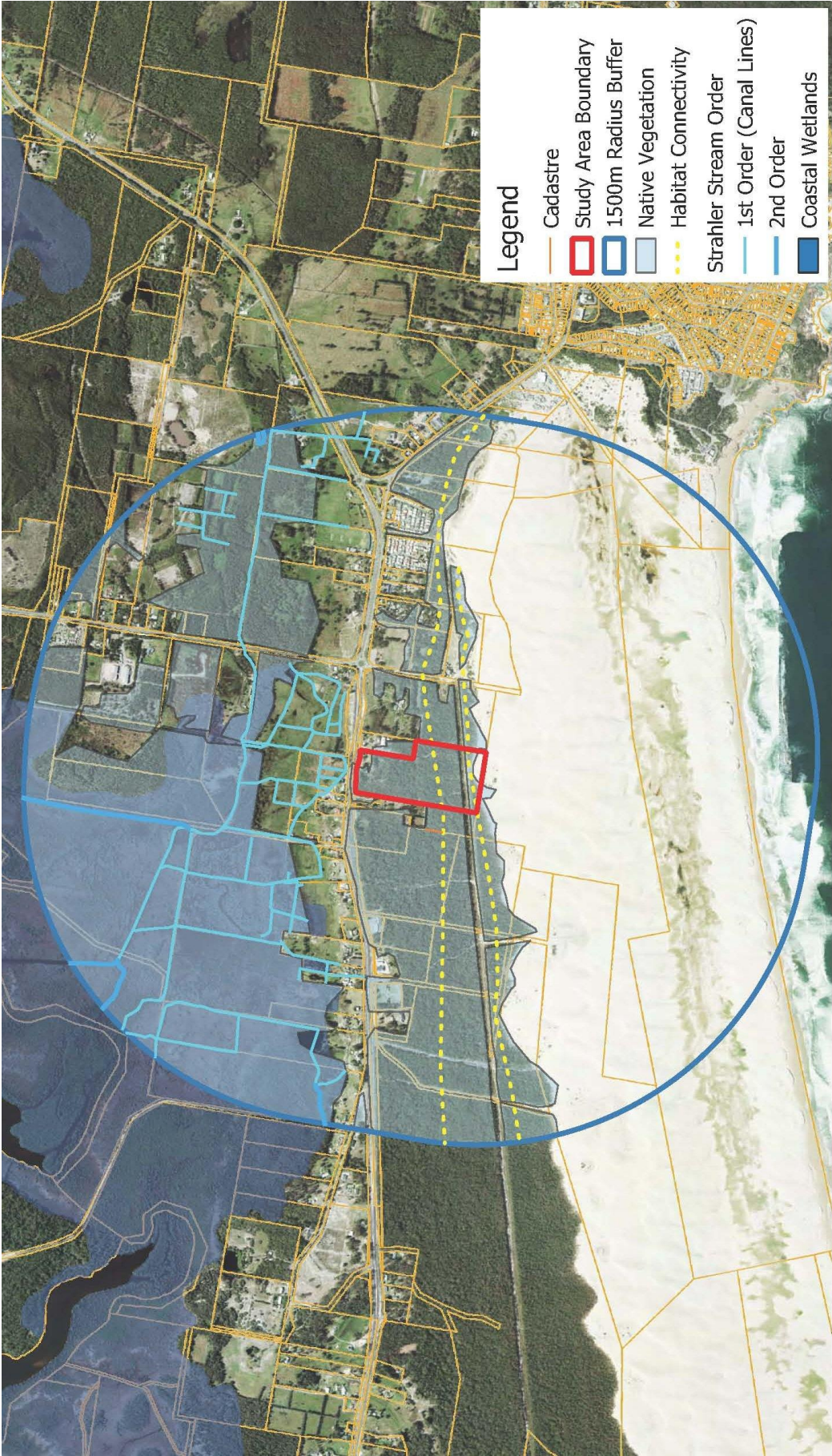
The study area falls entirely within the Sydney Newcastle Barriers and Beaches (SB Coastal Barriers) BioNet Landscape (formerly Mitchell Landscapes) (OEH 2016a). The Mitchell Landscapes within the vicinity of the study area are shown in Figure 3.1.

3.3 RIVERS AND STREAMS

The study area is located within the Hunter Central Rivers Catchment According to the NSW Government SEED mapping, no rivers, streams and estuaries are present within the study area (NSW Gov 2018). This absence was confirmed during the field survey. A number of mapped minor canal lines were present to the north of the study area across Nelson Bay Road. In addition, there were a small number of 2nd order tributaries to Finnigans Island Creek approximately 2km north of the study area. Rivers, streams, estuaries and mapped canal lines within the vicinity of the study area are displayed in Figure 3.1.

3.4 WETLANDS

No important wetlands as defined in the Biodiversity Assessment Method Operational Manual – Stage 1 (OEH 2018f) were found to be present within the study area or occur downstream/adjacent to the study area. A Coastal Wetland (Coastal Management SEPP) was present approximately 0.65km to the



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Landscape Map

Lot 591 DP 1191380
Anna Bay, NSW
19 June 2018

Figure 3.1

0 0.5 1 km

Map Projection GDA94 MGA Zone 56

Author	BE
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Job Ref	12287
A4 Scale	1:22,000

north west of the study area, this wetland was not a listed as a wetland of International Importance developed under the Ramsar Convention (NSW Gov 2018) nor a DIWA listed wetland (DoEE 2108). The location of the Coastal Wetland in relation to the study area is shown in Figure 3.1.

3.5 CONNECTIVITY FEATURES

Habitat function within the study area is primarily associated with coastal sclerophyll forest. For mobile fauna species and seed/pollen dispersal of some flora species, habitat within the study area is connected to the vegetation of Worimi National Park to the west (Bell & Driscoll 2010). The Lower Hunter Regional Strategy (NSW Department of Planning 2006) identifies this area as part of a key green corridor linking large vegetated areas, allowing the movement and dispersal of biodiversity within the region. This corridor links the Watagan and Yengo National Parks with the coastal plains of the Tomago Sand beds, Stockton Bight and Port Stephens. The Lower Hunter and Central Coast Regional Biodiversity Conservation Strategy (House, 2003) also identifies the Coastal Sand Apple – Blackbutt Forest occurring along the Stockton Bight dune system as a regionally significant habitat linkage. Habitat connectivity in relation to the study area is shown in Figure 3.1.

3.6 GEOLOGY TOPOGRAPHY AND SOILS

The study area is located on the Port Stephens soil landscape, composed of Holocene sand sheets and beach ridges (Murphy, 1995). The soil consists of loamy sand throughout the majority of the study area. The topography is flat to undulating throughout the study area, with a sharp incline into sand dunes in the south of the study area. The southern portion of the study area borders Stockton Bight sand dunes and is characterised by transgressive sand dunes of marine and Aeolian Holocene sands. There are no karst, caves, cliffs or other areas of geological significance within the study area or within the surrounding assessment area.

3.7 HIGH AND OUTSTANDING BIODIVERSITY AREAS

There are currently no declared areas of Outstanding Biodiversity Value under the NSW Biodiversity Conservation Regulation 2017 associated with the study area.

The NSW Biodiversity Values Map was consulted on 25 May 2018, at this time it was observed that the study area does not fall within an area of high biodiversity value.

3.8 NATIVE VEGETATION EXTENT IN THE BUFFER AREA

The Biodiversity Assessment Method Operational Manual Stage 1 (OEH 2018f) defines 'Native Vegetation Cover' as:

“the amount of native vegetation (woody and non-woody vegetation including regrowth and plantations comprised of plants native to New South Wales) that is estimated to remain in the landscape proximal to the assessment area. It is used:

- *as a filter by the Calculator to predict threatened species likely to occur or use habitat on a site; and*
- *to define the intrinsic rate of increase in species richness and plant cover as part of the assessment of future vegetation condition on a biodiversity stewardship site”.*

Native vegetation extent within a 1500m buffer from the edge of the study area was estimated from review of aerial imagery and regional vegetation mapping and via field inspection and professional judgement. It was determined that 39.91% of native vegetation was present within the 1500m buffer including the vegetation within the study area, this value was accordingly input into the BAM-CC.

Native vegetation contained within a 1500m buffer of the study area is shown in Figure 3.1.

3.9 CLEARED AREAS

Cleared areas within the locality include roads, sand dunes, car parks, existing development, waterbodies and waterways (natural and man-made) and vacant land lots.

3.10 DIFFERENCES BETWEEN MAPPED VEGETATION EXTENT AND AERIAL IMAGERY

There were no significant differences between the mapped vegetation extent and that present within available aerial imagery.

4.0 STUDY AREA CONTEXT

This Section describes the study area context, describing the vegetation extent present within the study area, as required by the BAM (OEH 2017). The habitats and vegetation within the study area are a small subset of those in the wider landscape.

4.1 NATIVE VEGETATION EXTENT IN THE STUDY AREA

It was determined that the study area was composed of 84.10 % of native vegetation.

Area of study area: 13.66 ha

Native vegetation extent: 11.4886 ha

Cleared areas: 2.171 ha

Figure 4.1 provides a map of the native vegetation extent recorded within the study area and proposed development impact area, as assessed during field investigations undertaken in May 2018. The figure includes all areas of native vegetation (native ground cover and areas with canopy). Areas not shown as native vegetation cover within Figure 4.1 are not included for further assessment in accordance with Section 5.1.1.5 of the BAM unless they are determined within Section 8 of this report to be consistent with habitat for candidate species credit species as detailed within Section 6.4.1.37 of the BAM.

4.2 CLEARED AREAS AND NATIVE VEGETATION

The study area has had a history of past disturbance and clearing. A primary access track has been cleared running north to south to provide access to the sand dunes of Stockton Bight. A number of additional areas connected to the western most access track have also been cleared likely to provide vehicle turning bays and room for stockpiling.

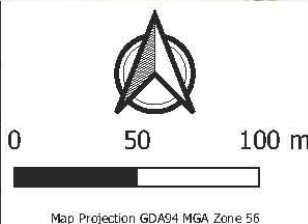
An area of native vegetation within the northern portion of the study area was observed to have been exposed to recent disturbance in the form of underscrubbing which has modified the midstorey and understorey layers and removed a number of less mature canopy trees.

An electricity transmission line easement runs east to west at the south of the site and a secondary access track is present within the east of the study area. The electricity transmission line easement has been cleared of all canopy vegetation and is frequently maintained (slashed) as part of periodic maintenance conducted by Ausgrid. The understorey of this community is composed of derived native grassland (DNG) consistent with the adjacent intact native coastal forest.

An area within the northern portion of the study area has been cleared and is primarily composed of disturbed non-native grassland and exotic weed species.



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4.3 DIFFERENCES BETWEEN MAPPED VEGETATION EXTENT AND AERIAL IMAGERY

Native vegetation extent and internal ecotone boundaries between communities were 'ground truthed' and mapped during fieldwork using a handheld Geographic Positioning System (GPS). During the survey period, notable differences between vegetation extent displayed in aerial imagery and what was observed during the surveying period were found. For most of the study area this can be attributed to the vegetation disturbance activities that are detailed in Section 4.2. Within the south of the study area it was observed that the transgressive sand dunes of Stockton Bight have advanced north further into the study area and have reduced the extent of woodland present south of the transmission easement.

5.0 PLANT COMMUNITY TYPES

This Section describes the attribution of vegetation community profile descriptors to vegetation surveyed within the study area in accordance the NSW Plant Community Types (PCTs) held within the NSW BioNet Vegetation Information System (BioNet VIS) database.

5.1 PLANT COMMUNITY TYPE (PCT) ASSESSMENT METHOD

Existing site reports as well as database searches (See Section 1.3) were reviewed to inform the study area investigations. In addition, a search was undertaken of the BioNet VIS Database (OEH 2018h) and NSW SEED mapping to access existing vegetation mapping information within the study area. It was determined that the mapping dataset, Worimi Conservation Lands Vegetation 2010. (VIS_ID 3903) (Bell & Driscoll 2010), was the most appropriate to use for the context of the study area as it was both fine scale, current and contains the broader context of vegetation types present in the locality. Accordingly, this mapping data (VIS_ID 3903) was adopted as a 'base map' to inform field studies of vegetation extent and type within the study area and representation of the extent within the region. Based on the results of the background review and the requirements of the BAM with respect to this BDAR, appropriate surveys were designed for the study area.

The vegetation base map was used to guide a floristic assessment of the study area. Supplementary iterations and amendments were made to the base map throughout the fieldwork period, in accordance with Section 5.2 of the BAM, via hand-held GPS units and aerial photo interpretation. Iterations to the base map were based on observation of broad vegetation composition, landform, physiography and on quantitative data collection through identification of all plants encountered to the species level.

The vegetation types observed were compared to the base map and cross-referenced with the community profile descriptors (and diagnostic species tests) held within the BioNet VIS Database (OEH 2018h) with an assessment of consistency being conducted. Details of the most consistent PCTs selected are detailed in Section 5.2 below.

5.2 PCTS IDENTIFIED WITHIN THE STUDY AREA

Two Plant Community Types (PCT) were determined to be present within the study area, being:

- PCT-1648 - Smooth-barked apple - blackbutt heathy open forest of the Tomaree Peninsula
- PCT-1204 - Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion

A comprehensive description of each PCT present within the study area is provided in Tables 5.1 and 5.2 below. Where relevant the PCTs identified in the field were equated to Threatened Ecological Communities (TECs/EECs) listed under the EPBC Act and TSC Act respectively. Figure 5.1 provides a map of the extent of each PCT within the study area.



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0 50 100 m



Map Projection GDA94 MGA Zone 56

Figure 5.1

Plant Community Type Map

Lot 591 DP 1191380
Anna Bay, NSW

19 June 2018

Table 5.1: Details of PCT 1648

Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula (PCT 1648)	
Vegetation Formation	Dry Sclerophyll Forest (Shrubby sub-formation)
Vegetation Class	Coastal Dune Dry Sclerophyll Forest
Extent within study area	11.404 ha comprises all treed vegetation and derived native grassland within the study area
Associated Species*	Angophora costata, <i>Corymbia gummifera</i>, Eucalyptus pilularis / Banksia serrata, <i>Acacia terminalis</i>, Bossiaea rhombifolia, <i>Dillwynia retorta</i>, <i>Eriostemon australasius</i>, Acacia suaveolens, Ricinocarpus pinifolius, Acacia ulicifolia, Persoonia levis / Themeda australis, <i>Leucopogon ericoides</i>, <i>Tetratheca ericifolia</i>, <i>Hypolaena fastigiata</i>, Pteridium esculentum, <i>Epacris pulchella</i> *The associated species above which occurred within the study area and informed assignment of this PCT have been made bold
Justification of PCT	The forest within the study area was composed of a diverse range of flora far exceeding the list of typically associated species above. The PCT assigned to this forest was initially determined by entering dominant canopy species and the IBRA bioregion into the BioNet vegetation classification database, a shortlist of two PCTs was collected that were considered to have potential to occur within the locality, these were: - PCT-1648 - Smooth-barked apple - Blackbutt heathy open forest of the Tomaree Peninsula - PCT 1646 - Smooth-barked Apple - Blackbutt - Old Man Banksia woodland on coastal sands of the Central and Lower North Coast The short list of PCTs above were cross referenced with the floristic inventory collected for the study area. Of the PCTs short listed, PCT 1648 contained the highest number of typically associated species, in addition this community is prescriptive to the landscape location of the study area, the Tomaree Peninsula
TEC Status	This PCT can form part of the TEC River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions, which is listed as Endangered under Schedule 2 of the BC Act. No occurrence of this PCT within the study area was situated within a floodplain, thus this PCT was not found to be consistent with this TEC.
Estimate of % Cleared	57%
Example of PCT 1648 within the study area 	

Table 5.2: Details of PCT 1204

Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion (PCT 1204)	
Vegetation Formation	Grasslands
Vegetation Class	Maritime Grasslands
Extent within study area	0.11 ha
Typically Associated Species	<i>Spinifex sericeus</i>; <i>Austrofestuca littoralis</i>; <i>Carpobrotus glaucescens</i>; <i>Calystegia soldanella</i>; <i>Actites megalocarpa</i>; <i>Isolepis nodosa</i> *The associated species above which occurred within the study area and informed assignment of this PCT have been made bold.
Justification of PCT	The transgressive sand dunes within the south of the study area were predominately absent of vegetation. Discrete occurrences of <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i> (bitou bush) thickets and small patches of homeogenous <i>Spinifex sericeus</i> (hairy spinifex) grassland were present on the top of the dune. The PCT assigned to the patches of homogenous hairy spinifex grassland was initially determined by entering this species and the IBRA bioregion into the BioNet vegetation classification database, a single PCTs within the North Coast IBRA bioregion was listed which contains hairy spinifex, this was: - PCT 1272 - <i>Themeda australis</i> sod tussock grassland of coastal areas of the NSW North Coast Bioregion As this PCT is not consistent with transgressive sand dunes it was discounted as being consistent with the vegetation present. A new search was conducted not applying a location setting within an IBRA Bioregion. This search produced a shortlist of six PCTs which had a vegetation class of maritime grasslands, these were - PCT 779 - Coastal dune swale wetland at Cape Howe, far southern South East Corner Bioregion - PCT 1204 - Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion - PCT 897 - Kangaroo Grass sod tussock grassland of coastal areas of the Sydney Basin Bioregion - PCT 898 - Kangaroo Grass sod tussock grassland of coastal areas of the Sydney Basin Bioregion and South East Corner Bioregion - PCT 1697 - Kangaroo Grass - Coastal Rosemary grassland on coastal headlands The short list of PCTs above were cross referenced with typically associated landscapes, soil types and their distribution within NSW. Of the PCTs shortlisted, PCT 1648, was the most likely to occur on an underlying soil type of transgressive sand dunes. As such, it was selected as the most appropriate PCT.
TEC Status	This PCT is not likely to form part of a TEC
Estimate of % Cleared	38%
Example of PCT 1204 within the study area 	

6.0 VEGETATION ZONES

This Section describes the attribution of vegetation zones to PCTs identified within Section 4.0 of this report. Designation of vegetation zones was undertaken accordance with the methodology for vegetation integrity assessment outlined within Section 5.3 of the BAM (OEH, 2017).

6.1 VEGETATION ZONES ASSESSMENT METHOD

Detailed floristic surveys were undertaken on 29 March and 23 and 25 May, 2018. This survey included the establishment of vegetation integrity plots across the study area. The survey effort (number of vegetation integrity plots established, per vegetation zone) was undertaken in accordance with Table 2 in the BAM (OEH, 2017). Data on the composition, structure and function of the vegetation was collected utilising the methodology presented in the (BAM, 2017) by persons trained in the BAM and under the direction of persons accredited under the BAM. The field data collected during the vegetation integrity assessment can be found in Appendix C.

Two PCTs were identified in the study area. Each PCT was considered in terms of if they should be further stratified into separate vegetation zones on the basis of current condition state / management or other environmental variables. The random meander, overview inspection and detailed floristic plots have been used to inform the stratification of PCTs into vegetation zones.

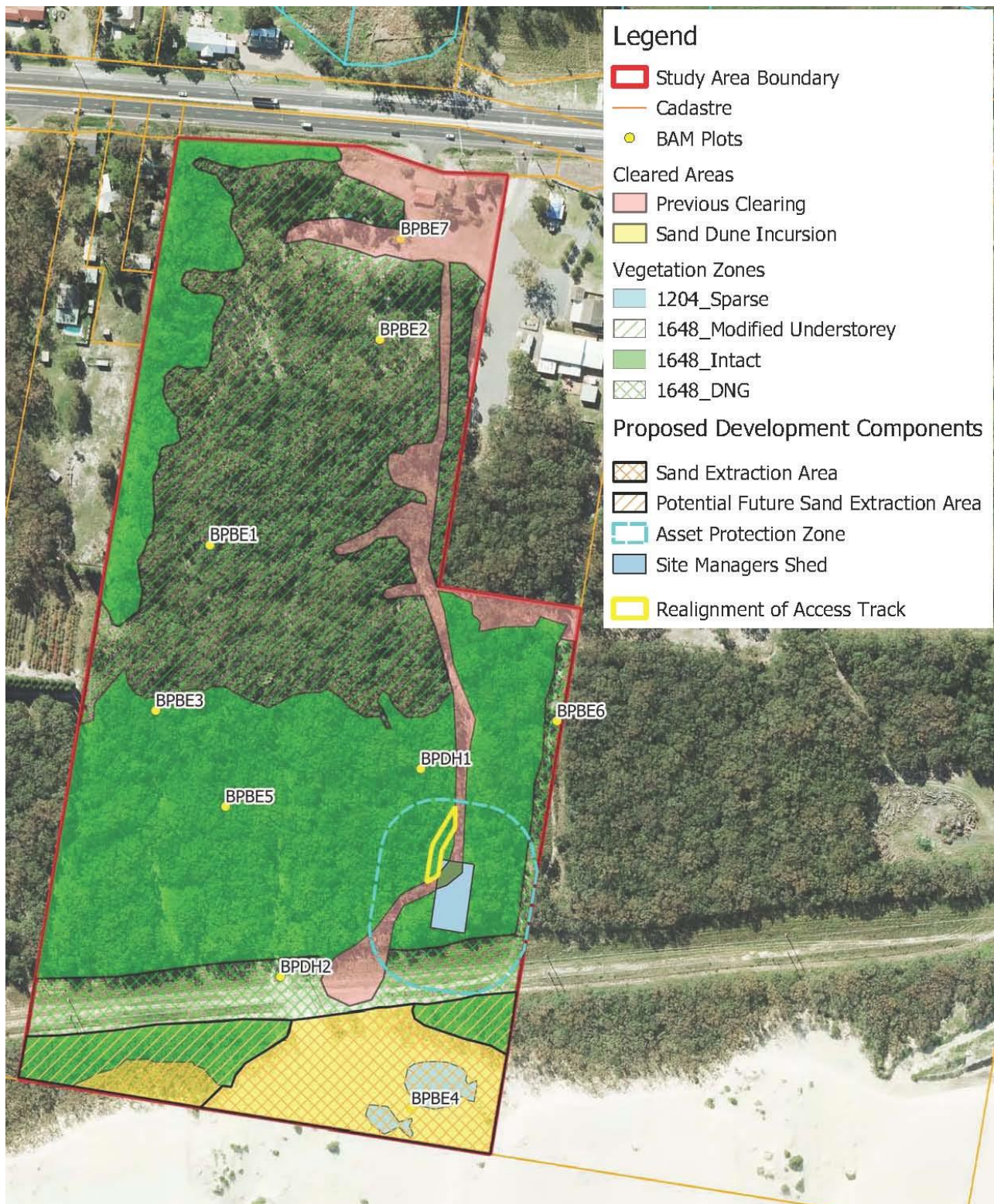
Only PCT 1648 was stratified, on the basis of the broad presence/absence of key strata over the study area, these vegetation zones were attributed with a vegetation zone ID, which are

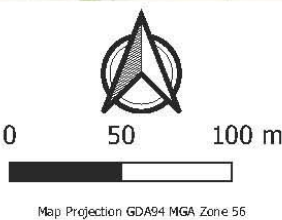
- 1648_Intact
- 1648_Modified Understorey
- 1648_DNG

The other PCT present, PCT 1204, was considered to be homogenous within its occurrence on the study area and well represented by the plot data. As such this PCT was attributed with a single vegetation zone ID, which was

- 1204_Sparse

An aerial photo showing the extent of the four Vegetation Zones present within the study area, the intersection of vegetation zones with the proposed developments project components and the location of the vegetation integrity plots is shown in Figure 6.1. Polygons of vegetation zone extent and internal ecotone boundaries were mapped in accordance with Subsection 5.3.1 of the BAM, using a combination of field observations and aerial imagery interpretation at a minimum scale of 1:10,000. Table 6.1 provides details of the vegetation zones within the study area. The plot data from the vegetation integrity survey plots were entered into the BAM credit calculator (BAM-CC). The results from the vegetation integrity assessment are provided in Table 6.2.



Author	BE		Figure 6.1 Vegetation Zones Map Lot 591 DP 1191380 Anna Bay, NSW 19 June 2018
Reviewer	DH		
Job Ref	12287		
A4 Scale	1:2,500		

6.2 PATCH SIZE

Patch size is defined in the BAM (OEH, 2017) as an area of intact native vegetation that:

- *occurs on the study area or biodiversity stewardship site, and*
- *includes native vegetation that has a gap of less than 100m from the next area of moderate to good condition vegetation (or $\leq 30\text{m}$ for non woody ecosystems). Patch size may extend into adjoining land that is not part of the study area or biodiversity stewardship site.*

The BAM (OEH, 2017) defines 'intact native vegetation' as:

- *Intact vegetation: vegetation where all tree, shrub, grass and/or forb structural growth form groups expected for a plant community type are present.*

As described in Section 6.1 above PCT 1648 was stratified broadly into three condition classes by the absence of key structural layers, which are:

- 1648_Intact
- 1648_Modified Understorey
- 1648_DNG

All of the above vegetation zones contained all growth form groups expected for the PCT 1648, even if severely reduced from disturbance in the case of 1648_Modified Understorey and 1648_DNG. As such all of the above vegetation zones would be considered intact native vegetation in accordance with the definitions provided in the BAM methodology.

The above mentioned vegetation zones were connected to a large area of coastal forest running parallel to Stockton Bight, namely Woromi National Park extending across an area of approximately 2500 ha. Therefore, each of the Vegetation Zones above have been attributed with a patch size class of $\geq 100\text{ha}$.

PCT 1204, was attributed with a single vegetation zone ID, which was

- 1204_Sparse

This vegetation zone was found to be comprised of sparse occurrences of a single native species, hairy spinifex. This vegetation zone does not meet the definition of intact native vegetation listed within the BAM as it was missing key structural growth form groups expected for this PCT. As such, this vegetation zone has been attributed with a patch size class of 0ha.

Table 6.1: Details of Vegetation Zones within the Study Area

PCT ID	PCT Name	Vegetation Zone ID/Condition	No. of Vegetation Integrity Plots Established	Area Total (ha)	Patch Size (ha)	Example of Vegetation Zone
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	1648 Intact This vegetation zone was dominated by the canopy species <i>Eucalyptus pilularis</i> (Blackbutt) and <i>Angophora costata</i> (Smooth-barked Apple). The mid-storey was dominated by <i>Banksia serrata</i> (Old Man Banksia) as well as <i>Pittosporum undulatum</i> (Sweet Pittosporum) and <i>Glochidion ferdinandi</i> (Cheese Tree). The understorey of this community was moderately intact, however it was evident that some areas had been underscrubbed in the past and this community was in a stage of recovery post-disturbance. This vegetation zone had an intact understorey.	2	5.727	>100	

PCT ID	PCT Name	Vegetation Zone ID/Condition	No. of Vegetation Integrity Plots Established	Area Total (ha)	Patch Size (ha)	Example of Vegetation Zone
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	1648_Modified Understorey This zone had a species assemblage consistent with vegetation zone 1648_Intact. However, the midstorey and understorey for this community was severely reduced after recent disturbance in the form of under scrubbing and also had a far reduced abundance of less mature canopy trees, which are likely to have been removed during under scrubbing.	3	4.5617	>100	

PCT ID	PCT Name	Vegetation Zone ID/Condition	No. of Vegetation Integrity Plots Established	Area Total (ha)	Patch Size (ha)	Example of Vegetation Zone
1648	Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula	1648_DNG This vegetation zone was located within the Ausgrid electrical easement in the south of the study area and along a maintained access track in the east of the study area. This easement area had been previously cleared of trees and shrubs and is maintained as a lower ground cover. Common ground cover species within this community were <i>Themeda triandra</i> (Kangaroo Grass), <i>Imperata cylindrica</i> var. <i>major</i> (Blady Grass), <i>Cymbopogon refractus</i> (Barbed Wire Grass) and <i>Pteridium esculentum</i> (Bracken Fern). Several native shrub species were present within this community including <i>Acacia suaveolens</i> (Sweet Wattle), <i>Pimelea linifolia</i> (Rice Flower) and <i>Bossiaea rhombifolia</i> as well as sapling <i>Eucalytus pilularis</i> (Blackbutt), <i>Angophora costata</i> (Smooth-barked Apple) and <i>Banksia serrata</i> (Old Man Banksia).	2	1.1152	>100	

PCT ID	PCT Name	Vegetation Zone ID/Condition	No. of Vegetation Integrity Plots Established	Area Total (ha)	Patch Size (ha)	Example of Vegetation Zone
1204	Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion	1204_Sparse This vegetation zone was located on the sand dune incursion within the south of the study area. Vegetation within this area was very sparsely distributed, with only small patches containing <i>Spinifex sericeus</i> (Coastal Spinifex) as well as the introduced <i>Chrysanthemoides monilifera</i> subsp. <i>monilifera</i> (Bitou Bush), <i>Cakile edentula</i> (American Sea Rocket) and <i>Hydrocotyle bonariensis</i> (Kurnell Curse).	1	0.11	>100	

Table 6.2: Vegetation integrity Scores

Vegetation Integrity Plot ID	Vegetation Zone ID	Composition Score	Structure Score	Function Score	Vegetation Integrity Score
BPBE3	1648_Intact	62.7	64	60.8	62.5
BPBE5					
BPBH2					
BPBE1	1648_Modified Understorey	63.9	34.7	79.5	56.1
BPBE2					
BPDH1	1648_DNG	52.5	25.3	22.8	31.2
BPBE6					
BPBE4	1204_Sparse	2	0.2	N/A ¹	0.6
¹ Function scores are not assessable for Vegetation Zones which are consistent with a vegetation formation of grasslands					

6.2 EXCLUSION OF VEGETATION ZONES FROM FURTHER ASSESSMENT

As outlined in Section 3.1.1.3 of the BAM if a vegetation zone has a vegetation integrity score of:

- *<15 where the PCT is representative of an endangered or critically endangered ecological community, or*
- *<17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community.*
- *<20 where the PCT is not representative of a TEC or associated with threatened species habitat.*

then for that vegetation zone

- *assessment of native vegetation is not required beyond Section 5.4 (determining vegetation integrity score), and*
- *an assessment of threatened species habitat according to Section 6.2 and Paragraph 6.2.1.4 (Assessing habitat suitability for species that can be predicted by habitat surrogates (ecosystem credits)) is not required.*

Vegetation zone 1204_Sparse is not a TEC, however it is associated with some threatened species habitat. As such, with a vegetation integrity score of 0.6 (ie. ≤ 17), further assessment of habitat suitability for ecosystem credit species associated with this vegetation zone within Section 7.0 of this report is not required.

7.0 ECOSYSTEM CREDIT SPECIES

This Section identifies and assesses the suitability of habitat constraints within the study area for ecosystem credit species. Ecosystem credit species are threatened species where the likelihood of occurrence of a species or elements of the species' habitat can be predicted by habitat surrogates and landscape features, or for which targeted survey has a low probability of detection. Targeted survey is not required for these species.

Ecosystem credit species are pre-determined by OEH in the BAM-CC (OEH, 2018g) based on the data collected and displayed in Section 3.6 of this report.

The BAM methodology defines a two-step process of habitat suitability assessment for ecosystem credit species, these are:

- 1) identify ecosystem credit species for assessment; and
- 2) assessment the habitat constraints and vagrant species on the subject land

These steps have been carried out in the following Sections.

7.1 ECOSYSTEM CREDIT SPECIES FOR ASSESSMENT (STEP 1)

A total of 32 ecosystem credit species have been generated from the BAM-CC (OEH 2018) as requiring assessment and are listed in Table 7.1. Relevant databases and literature was reviewed (See Table 1.1) for additional ecosystem credit species for assessment. Three additional ecosystem credit species were added for assessment, namely *Ephippiorhynchus asiaticus* (Black-necked Stork), *Tyto longimembris* (Eastern Grass Owl) and *Pseudomys novaehollandiae* (New Holland Mouse). Of the species in Table 7.1, 21 have been recorded within a 10km radius of the study area. Three ecosystem credit species for assessment have been recorded within the study area, namely *Haliaeetus leucogaster* (White-bellied Sea-Eagle) and *Miniopterus australis* Little Bentwing-bat.

Table 7.1: Ecosystem Credit Species for Assessment

Scientific Name	Common Name	Conservation Status ¹		BAM-CC Vegetation Association or Recorded Database
		BC Act	EPBC Act	
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Foraging)	V	E	PCT_1648
<i>Calyptrorhynchus lathamii</i> ²	Glossy Black-Cockatoo (Foraging)	V		PCT_1648
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork	E		BioNet
<i>Tyto longimembris</i>	Eastern Grass Owl	V		BioNet
<i>Pseudomys novaehollandiae</i>	New Holland Mouse		V	BioNet
<i>Daphoenositta chrysoptera</i>	Varied Sittella	V		PCT_1648
<i>Dasyurus maculatus</i>	Spotted-tailed Quoll	V	E	PCT_1648
<i>Falsistrellus tasmaniensis</i>	Eastern False Pipistrelle	V		PCT_1648
<i>Glossopsitta pusilla</i>	Little Lorikeet	V		PCT_1648
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Foraging)	V		PCT_1648
<i>Hieraaetus morphnoides</i>	Little Eagle (Foraging)	V		PCT_1648
<i>Kerivoula papuensis</i>	Golden-tipped Bat	V		PCT_1648
<i>Lathamus discolor</i>	Swift Parrot (Foraging)	E	CE	PCT_1648
<i>Lophoictinia isura</i>	Square-tailed Kite (Foraging)	V		PCT_1648
<i>Melithreptus gularis gularis</i>	Black-chinned Honeyeater (eastern subspecies)	V		PCT_1648
<i>Miniopterus australis</i>	Little Bentwing-bat (Foraging)	V		PCT_1648
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Foraging)	V		PCT_1648
<i>Mormopterus norfolkensis</i>	Eastern Freetail-bat	V		PCT_1648
<i>Neophema pulchella</i>	Turquoise Parrot	V		PCT_1648
<i>Ninox connivens</i>	Barking Owl (Foraging)	V		PCT_1648
<i>Ninox strenua</i>	Powerful Owl (Foraging)	V		PCT_1648

Scientific Name	Common Name	Conservation Status ¹		BAM-CC Vegetation Association or Recorded Database
		BC Act	EPBC Act	
<i>Pandion cristatus</i>	Eastern Osprey (Foraging)	V		PCT_1648
<i>Petaurus australis</i>	Yellow-bellied Glider	V		PCT_1648
<i>Phascolarctos cinereus</i>	Koala (Foraging)	V	V	PCT_1648
<i>Pomatostomus temporalis temporalis</i>	Grey-crowned Babbler (eastern subspecies)	V		PCT_1648
<i>Pseudomys gracilicaudatus</i>	Eastern Chestnut Mouse	V		PCT_1648
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Foraging)	V		PCT_1648
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tail-bat	V		PCT_1648
<i>Scoteanax rueppellii</i>	Greater Broad-nosed Bat	V		PCT_1648
<i>Sternula albifrons</i>	Little Tern (Foraging)	E		PCT_1648
<i>Syconycteris australis</i>	Common Blossom-bat	V		PCT_1648
<i>Tyto novaehollandiae</i>	Masked Owl (Foraging)	V		PCT_1648
Legend E=Endangered Species V=Vulnerable Species CE=Critically Endangered * Cells highlighted blue indicate species has been previously recorded as occurring within a 10km radius of the study area within databases reviewed within Section 1.3 of this report.				

7.2 ECOSYSTEM CREDIT SPECIES ASSESSMENT (STEP 2)

Under this step of the BAM the assessor may opt to undertake an additional assessment of the habitat constraints on the subject land for the ecosystem credit species predicted by the BAM-CC.

All species that were associated with PCT_1648 were assumed to occur and generate ecosystem credits. As stated within Section 6.2 of this report, all ecosystem credit species associated with PCT 1204 were excluded assessment and credit generation as all consistent vegetation zones within the study area had a vegetation integrity score of <17.

8.0 SPECIES CREDIT SPECIES

This Section identifies and assesses the suitability of habitat present within the study area for species credit species. Species credit species are threatened species where the likelihood of occurrence of a species or elements of suitable habitat for the species cannot be confidently predicted by vegetation surrogates and landscape features and can be reliably detected by survey. Targeted survey is required for these species which are not excluded from assessment in Section 8.2.

Species credit species are pre-determined by the BAM-CC based on the data collected and displayed in Section 3.6 of this report. The residual impact on the species' habitat from development, clearing is measured in biodiversity credits using the vegetation integrity score for each vegetation zone.

The BAM assessment defines a six step process for identifying habitat suitability for species credit species, this is:

- 1) identify species credit species for assessment,
- 2) assess the habitat constraints for species credit species on the Subject land,
- 3) identify candidate species credit species for further assessment,
- 4) determine presence or absence of a candidate species credit species,
- 5) determine the area or count, and location of suitable habitat for a species credit species; and
- 6) determine the habitat condition within the species polygon for species assessed by area.

These steps have been carried out in Sections 8.1- 8.7 below.

8.1 SPECIES CREDIT SPECIES FOR ASSESSMENT (STEP 1)

A total of 50 species credit species have been generated from the BAM-CC (OEH, 2018) as requiring assessment and are listed in Table 8.1. Relevant databases and literature was reviewed (See Table 1.1) for additional species credit species for assessment, three additional species credit species were added for assessment, namely *Petalura gigantea* (Giant Dragonfly), *Haematopus fuliginosus* (Sooty Oystercatcher) and *Syzygium paniculatum* (Magenta Lilly Pilly).

Of the species in Table 8.1, 33 have been recorded within a 10km radius of the study area. Three species credit species for assessment have been recorded within the study area, namely *Diuris praecox* (Rough Doubletail), *Haliaeetus leucogaster* (White-bellied Sea-Eagle), *Miniopterus australis* (Little Bentwing-bat), accordingly these species were given a higher level of examination within steps 2-6 below.

Table 8.1: Species Credit Species for Assessment

Scientific Name	Common Name	Conservation Status ¹		Serious and Irreversible Impact Entity (SII)
		BC Act	EPBC Act	
<i>Angophora inopina</i>	Charmhaven Apple	V	V	No
<i>Burhinus grallarius</i>	Bush Stone-curlew	E		No
<i>Callistemon linearifolius</i>	Netted Bottle Brush	V		No
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	V		No
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Breeding)	V		No
<i>Petalura gigantea</i>	Giant Dragonfly	E		Yes
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	V		No
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	E	V	No
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	V		No
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	V	V	Yes
<i>Chamaesyce psammogeton</i>	Sand Spurge	E		No
<i>Corybas dowlingii</i>	Red Helmet Orchid	E		No
<i>Crinia tinnula</i>	Wallum Froglet	V		No
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	V	V	No
<i>Diuris arenaria</i>	Sand Doubletail	E		Yes
<i>Diuris praecox</i>	Rough Doubletail	V	V	No
<i>Dromaius novaehollandiae</i> - endangered population	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	E1		No
<i>Esacus magnirostris</i>	Beach Stone-curlew (Breeding)	CE		Yes Mapped important areas - contact OEH for maps
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	V	V	No
<i>Eucalyptus parramattensis</i> subsp. <i>decadens</i>		V	V	No
<i>Haematopus longirostris</i>	Pied Oystercatcher	E		No
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	V		No
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	V		No
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	V		No
<i>Lathamus discolor</i>	Swift Parrot (Breeding)	E	CE	Yes Mapped important areas - contact

Scientific Name	Common Name	Conservation Status ¹		Serious and Irreversible Impact Entity (SAIL)
		BC Act	EPBC Act	
				OEH for maps
<i>Litoria brevipalmata</i>	Green-thighed Frog	V		No
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	V		No
<i>Melaleuca groveana</i>	Grove's Paperbark	V		No
<i>Miniopterus australis</i>	Little Bentwing-bat (Breeding)	V		Yes No threshold or spatial data provided
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Breeding)	V		Yes No threshold or spatial data provided
<i>Myotis macropus</i>	Southern Myotis	V		No
<i>Ninox connivens</i>	Barking Owl (Breeding)	V		No
<i>Ninox strenua</i>	Powerful Owl (Breeding)	V		No
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	V		No
<i>Petaurus norfolcensis</i>	Squirrel Glider	V		No
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	E	V	Yes No threshold or spatial data provided
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	V		No
<i>Phascolarctos cinereus</i>	Koala (Breeding)	V	V	No
<i>Phascolarctos cinereus</i> - endangered population	Koala, Hawks Nest and Tea Gardens population	E1		No
<i>Planigale maculata</i>	Common Planigale	V		No
<i>Prostanthera densa</i>	Villous Mint-bush	V	V	No
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Breeding)	V	V	No
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	V	E	Yes No threshold or spatial data provided
<i>Sternula albifrons</i>	Little Tern (Breeding)	E		No
<i>Tetratheca juncea</i>	Black-eyed Susan	V	V	No
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	V		No
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	E		No
<i>Vespadelus troughtoni</i>	Eastern Cave Bat	V		Yes No threshold or

Scientific Name	Common Name	Conservation Status ¹		Serious and Irreversible Impact Entity (SII)
		BC Act	EPBC Act	
				spatial data provided
<i>Xenus cinereus</i>	Terek Sandpiper (Breeding)	V		No
Legend E=Endangered Species E1=Endangered Population V=Vulnerable Species CE=Critically Endangered * Cells highlighted blue indicate species has been previously recorded as occurring within a 10km radius of the study area within databases reviewed within Section 1.3 of this report.				

8.2 ASSESSMENT OF HABITAT CONSTRAINTS FOR SPECIES CREDIT SPECIES (STEP 2)

For the species credit species predicted to occur in Step 1, for which habitat constraints are listed, an assessment was undertaken for the presence of the habitat constraints within the study area. Habitat constraints for species credit species are identified in the BAM-CC and the Threatened Species Biodiversity Data Collection. The absence of habitat constraints for species credit species precludes the species from requiring further assessment in Steps 3-6. This assessment is not applicable to a species where no habitat constraints are listed in the BAM-CC and TBDC, e.g. threatened flora.

The methodology for the habitat constraints survey is provided below in Section 8.3. The results of the habitat constraints survey and an evaluation of species credit species for further assessment is provided in Table 8.2.

8.3 METHODOLOGY FOR DETERMINING HABITAT CONSTRAINTS

Significant Tree Inventory

A significant tree inventory was conducted by Wildthing Environmental Consultants over the entire study area. The survey identified the presence of any significant habitat attributes or characteristics within all trees present within the study area, this included the following:

- tree species, height, diameter at breast height (dbh) and location (taken on a handheld GPS),
- the size and number of any hollows, woodland bird nests or eyries present*,
- the presence or evidence of any breeding camps of megachiropteran bats,
- the presence of scansorial (climbing) mammal evidence in the form of scratches, scats on the trunks of trees and scats around the base; and
- the presence of any resting arboreal mammals, i.e. Koala

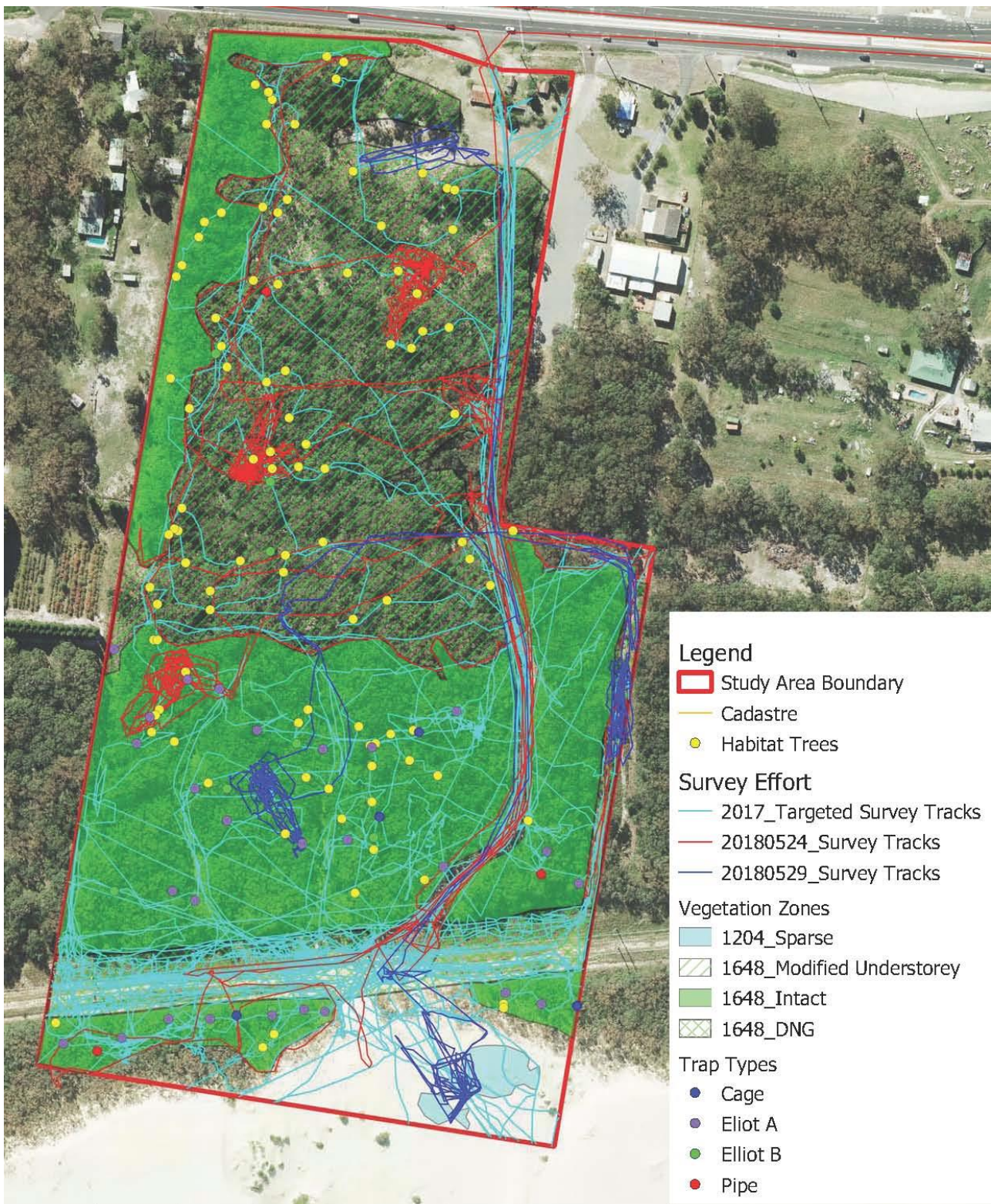
A map of recorded significant trees is provided in Figure 8.1.

Searches for Fallen/Standing Dead Timber

The presence of fallen and standing dead timber within each vegetation zone was qualitatively assessed for its potential to provide significant refuge resources to ground dwelling mammals, birds amphibians and reptiles.

Searches for Significant Geological Features and Suitable Artificial Structures

The presence of significant geological features and/or suitable artificial structures within each vegetation zone was qualitatively assessed for its potential to provide significant refuge resources to saxicolous (rock dwelling) and cave dwelling fauna such as microchiropteran bats, reptiles and some marsupials.



Author	BE
Reviewer	DH
Job Ref	12287
A4 Scale	1:2,500



0 50 100 m



Map Projection GDA94 MGA Zone XX

Figure B.1
Survey Effort and Habitat Constraints Map
Lot 591 DP 1191380 Anna Bay, NSW
19 June 2018

Searches for Habitat Constraints within the Landscape

The occurrence of some species credit species can be defined by the presence of specific habitat constraints within the greater landscape outside of the confines of the study area. These species credit species are generally highly mobile species with a large range/territory i.e. Microchiropteran bats (microbats), woodland birds and some terrestrial mammals.

Information collected in Section 3.6 has been used to inform the likely presence/absence of habitat constraints within the landscape, with justification of the determination reached provided in Table 8.2. Where the presence/absence of habitat features within the locality could not be determined with a high level of confidence or justified from desktop assessment resources a conservative approach has been used and the habitat constraint has been assumed present within the landscape.

Mapped Breeding Habitat

For a small number of species, a habitat constraint may refer to a mapped location. Mapped locations identify areas that are considered important for the species (e.g. breeding areas or sites where multiple records have been located over multiple years). As defined in Section 6.4 of the BAM, if the study area is in a mapped location for a species, no targeted survey or further assessment is required (unless otherwise indicated in the TBDC); the species is considered to be present and the area of the subject land within the mapped location forms the species polygon used to generate species credits. Any remaining habitat on the subject land (e.g. foraging, unmapped locations) used by these species is assessed for ecosystem credits.

At the time of preparing this report, mapped breeding habitat for Little Tern and Terek Sandpiper had not been made publicly available by OEH. As such, provision of appropriate local knowledge in accordance with Section 2.2.2.1 of the BAM was undertaken. It was determined that “the Little Tern has never been recorded breeding north of the Sygna Shipwreck (Geographic Coordinates, Latitude - 32.858833 Longitude - 151.84394) and that the Terek Sandpiper has never been known to breed on or near to Stockton Sand Dunes” (*Pers. comm* Warren Mayers, National Parks and Wildlife Service, Nelson Bay, 06 June, 2018).

Table 8.2: Assessment of Habitat Constraints for Species Credit Species

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
<i>Angophora inopina</i>	Charmhaven Apple	Geographic	- South of Wootton(OEH 2018d)	Yes	The study area falls within the geographic restriction for this species.
<i>Burhinus grallarius</i>	Bush Stone-curlew	Other	- Fallen/standing dead timber including logs (OEH, 2018d)	Yes	The study area contains this feature.
<i>Callistemon linearifolius</i>	Netted Bottle Brush	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	Hollow bearing trees	Eucalypt tree species with hollows greater than 9 cm diameter (OEH, 2018g)	Yes	The study area contains this habitat constraint.
<i>Petalura gigantea</i>	Giant Dragonfly	Other	Within 500 m of swamps (OEH, 2018g)	No	The study area is not within 500m of this habitat constraint.
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher	Other	Within 100m of estuarine areas and the ocean (OEH, 2018g)	No	The study area is not within 100m of this habitat constraint.
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Calyptrorhynchus lathamii</i>	Glossy Black-Cockatoo (Breeding)	Hollow bearing trees	Living or dead tree with hollows greater than 15cm diameter and greater than 5m above ground. (OEH, 2018g)	Yes	The study area contains this habitat constraint.
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Chalinolobus dwyeri</i>	Large-eared Pied Bat	Cliffs	Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, or crevices,	No	A desktop evaluation of the landscape and geological mapping for the region indicates that the geology within 2km of the study area would not be support the formation of

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
			or within two kilometres of old mines or tunnels (OEH, 2018d)		significant caves, overhangs, escarpments, outcrops, or crevices nor likely to have been historically mined.
<i>Chamaesyce psammogeton</i>	Sand Spurge	Dunes	Fore-dunes or exposed headlands (OEH, 2018d)	Yes	The study area contains this feature.
<i>Corybas dowlingii</i>	Red Helmet Orchid	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Crinia tinnula</i>	Wallum Froglet	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Diuris arenaria</i>	Sand Doubletail	Geographic	South of Soldiers Point (OEH, 2018d)	Yes	The study area falls within the geographic restriction for this species.
<i>Diuris praecox</i>	Rough Doubletail	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Dromaius novaehollandiae</i> - endangered population	Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Esacus magnirostris</i>	Beach Stone-curlew (Breeding)	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Eucalyptus parramattensis subsp. decadens</i>		N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Haematopus longirostris</i>	Pied Oystercatcher	Other	Within 100m of estuarine areas and the ocean (OEH, 2018d)	No	The study area is not within 100m of this habitat constraint.
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	Other	Living or dead mature trees within suitable vegetation within 1km of a rivers, lakes, large dams or creeks, wetlands and coastlines (OEH, 2018g)	Yes	The study area contains this habitat constraint.
<i>Hieraaetus morphnoides</i>	Little Eagle (Breeding)	Other	Nest trees live (occasionally dead) large old trees within vegetation. (OEH, 2018fd)	No	The study area did not contain any eyrie bearing trees.
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Lathamus discolor</i>	Swift Parrot (Breeding)	Other	As per mapped areas (OEH, 2018g)	No	All mapped breeding areas for this species are located in Tasmania.
<i>Litoria brevipalmata</i>	Green-thighed Frog	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Lophoictinia isura</i>	Square-tailed Kite (Breeding)	Other	Nest trees (OEH, 2018g)	No	The study area did not contain any eyrie bearing trees.
<i>Melaleuca groveana</i>	Grove's Paperbark	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
<i>Miniopterus australis</i>	Little Bentwing-bat (Breeding)	Caves	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding (OEH, 2018g)	No	This species has previously been recorded within the study area and was recorded within the study area during current surveys. The study area did not contain caves or any other structure which was likely to provide breeding habitat. As this species is a dual ecosystem/species credit species and as relevant habitat constraints are not present within the study area this species has been assessed as an ecosystem credit species only.
<i>Miniopterus schreibersii oceanensis</i>	Eastern Bentwing-bat (Breeding)	Caves	Cave, tunnel, mine, culvert or other structure known or suspected to be used for breeding (OEH, 2018g)	No	The study area did not contain caves or any other structure which was likely to provide breeding habitat.
<i>Myotis macropus</i>	Southern Myotis	Hollow bearing trees	Within 200 m of riparian zone/other Bridges, caves or artificial structures within 200 m of riparian zone (OEH, 2018g)	No	Appropriate hollow-bearing trees (within 200m of a riparian zone) were not present within the study area. A number of hollow bearing trees within the north of the study area were within 200m of mapped canal lines. These canal lines would not provide suitable foraging habitat for this species nor were they considered representative of a riparian zone.
<i>Ninox connivens</i>	Barking Owl (Breeding)	Hollow bearing trees	Living or dead trees with hollows greater than 20 cm diameter and greater than 4m above the ground. (OEH, 2018g)	Yes	The study area contains this habitat constraint.

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
<i>Ninox strenua</i>	Powerful Owl (Breeding)	Hollow bearing trees	Living or dead trees with hollow greater than 20cm diameter (OEH, 2018g)	Yes	The study area contains this habitat constraint.
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	Other	Living and dead trees (>15m) or artificial structures within 100m of a floodplain for nesting. (OEH, 2018g)	Yes	The north of the study area contained trees greater than 15m in height and within 100m of a floodplain.
<i>Petaurus norfolcensis</i>	Squirrel Glider	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Petrogale penicillata</i>	Brush-tailed Rock-wallaby	Other	Land within 1 km of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines (OEH, 2018d)	No	A desktop evaluation of the landscape and geological mapping for the region indicates that the geology within 1km of the study area would not be conducive to the formation of rocky escarpments, gorges, steep slopes, boulder piles, rock outcrops or cliffines
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	Hollow bearing trees	N/A	Yes	The study area contains this habitat constraint.
<i>Phascolarctos cinereus</i>	Koala (Breeding)	Other	Areas identified via survey as important habitat (see comments) Important' habitat is defined by the density of koalas and quality of habitat determined by on-study area survey - contact OEH for more information. (OEH, 2018g)	No	Clarification of what constitutes 'important Koala breeding habitat' had not been made publicly available by OEH at the time of writing this report. Due to the high amount of previous records for Koala within the Atlas BioNet database, a conservative approach was taken and this habitat constraint was assumed present.
<i>Phascolarctos cinereus - endangered population</i>	Koala, Hawks Nest and Tea Gardens population	Other	Areas identified via survey as important habitat (see comments) (OEH, 2018g) Important' habitat is defined by the density of koalas and quality of	No	Clarification of what constitutes 'important Koala breeding habitat' had not been made publicly available by OEH at the time of writing this report. Due to the high amount of records for Koala (including Koalas within

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
			habitat determined by on-study area survey - contact OEH for more information. (OEH, 2018g)		this endangered population) within the Atlas BioNet database, a conservative approach was taken and this habitat constraint was assumed present.
<i>Planigale maculata</i>	Common Planigale	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Prostanthera densa</i>	Villous Mint-bush	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Pteropus poliocephalus</i>	Grey-headed Flying-fox (Breeding)	Other	Breeding camps (OEH, 2018g)	N/A	The study area did not contain any breeding camps of this species.
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Sternula albifrons</i>	Little Tern (Breeding)	Other	As per mapped areas (OEH, 2018g)	No	At the time of preparing this report mapped breeding habitat for Little Tern has not been made publicly available by OEH. This habitat constraint was determined to be absent via provision of appropriate local knowledge.
<i>Tetradlea juncea</i>	Black-eyed Susan	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	Hollow bearing trees	Living or dead trees with hollows greater than 20cm diameter. (OEH, 2018g)	Yes	The study area contains this habitat constraint.
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	N/A	N/A	N/A	This species has no defined habitat constraint and thus requires further assessment.

Scientific Name	Common Name	Habitat Constraint Category	Habitat Constraint Description	Habitat Constraint or geographic limitation represented within the study area	Justification
<i>Vespadelus trougtoni</i>	Eastern Cave Bat	Caves	- Within two kilometres of rocky areas containing caves, overhangs, escarpments, outcrops, crevices or boulder piles, or within two kilometres of old mines, tunnels, old buildings or sheds. (OEH, 2018d)	No	A desktop evaluation of the landscape and geological mapping for the region indicates that the geology within 2km of the study area would not be conducive to the formation of significant caves, overhangs, escarpments, outcrops, or crevices or likely to have been historically mined.
<i>Xenus cinereus</i>	Terek Sandpiper (Breeding)	Other	As per mapped areas (contact OEH for maps) (OEH, 2018d)	No	At the time of preparing this report mapped breeding habitat for Terek Sandpiper has not been made publicly available by OEH. This habitat constraint was determined to be absent via provision of appropriate local knowledge.

8.4 IDENTIFY CANDIDATE SPECIES CREDIT SPECIES FOR FURTHER ASSESSMENT (STEP 3)

After the habitat constraints assessment within Step 2 a list of candidate species credit species has been refined for further assessment. These candidate species credit species will require targeted survey to confirm their presence/absence within the study area. Candidate species for further assessment are listed in Table 8.2.

Table 8.3: Candidate Species Credit Species

Scientific Name	Common Name	Biodiversity Risk Weighting	Survey Period	Assumed to occur/survey/expert report	Present on study area	Species polygon Area or Count
<i>Angophora inopina</i>	Charmhaven Apple	1	Any	Surveyed	No	N/A
<i>Burhinus grallarius</i>	Bush Stone-curlew	2	Any	Surveyed	No	N/A
<i>Callistemon linearifolius</i>	Netted Bottle Brush	2	Jan-Mar & Sep-Dec	Surveyed	No	N/A
<i>Callocephalon fimbriatum</i>	Gang-gang Cockatoo (Breeding)	2	Oct-Jan	Surveyed	No	N/A
<i>Syzygium paniculatum</i>	Magenta Lilly Pilly	2	Any	Surveyed	No	N/A
<i>Calyptorhynchus lathami</i>	Glossy Black-Cockatoo (Breeding)	2	Mar-Aug	Surveyed	No	N/A
<i>Cercartetus nanus</i>	Eastern Pygmy-possum	2	Jan-Mar & Oct-Dec	Surveyed	No	N/A
<i>Chamaesyce psammogeton</i>	Sand Spurge	2	Any	Surveyed	No	N/A
<i>Corybas dowlingii</i>	Red Helmet Orchid	2	June-Aug	Surveyed	No	N/A
<i>Crinia tinnula</i>	Wallum Froglet	1.5	Any	Surveyed	No	N/A
<i>Cryptostylis hunteriana</i>	Leafless Tongue Orchid	2	Nov-Feb	Surveyed	No	N/A
<i>Diuris arenaria</i>	Sand Doubletail	3	Aug-Sept	Surveyed	No	N/A
<i>Diuris praecox</i>	Rough Doubletail	1.5	July-Aug	Surveyed	Yes	Area Polygon
<i>Dromaius novaehollandiae</i>	Emu population in	2	Any	Surveyed	No	N/A

Scientific Name	Common Name	Biodiversity Risk Weighting	Survey Period	Assumed to occur/survey/expert report	Present on study area	Species polygon Area or Count
- <i>endangered population</i>	the New South Wales North Coast Bioregion and Port Stephens local government area					
<i>Esacus magnirostris</i>	Beach Stone-curlew (Breeding)	2	Any	Surveyed	No	N/A
<i>Eucalyptus camfieldii</i>	Camfield's Stringybark	2	Any	Surveyed	No	N/A
<i>Eucalyptus parramattensis subsp. decadens</i>		2	Any	Surveyed	No	N/A
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle (Breeding)	2	Jul-Dec	Surveyed	No	N/A
<i>Hoplocephalus bitorquatus</i>	Pale-headed Snake	2	Nov-March	Surveyed	No	N/A
<i>Litoria brevipalmata</i>	Green-thighed Frog	1.5	Oct-Mar	Surveyed	No	N/A
<i>Melaleuca groveana</i>	Grove's Paperbark	2	Any	Surveyed	No	N/A
<i>Ninox connivens</i>	Barking Owl (Breeding)	2	May-Dec	Surveyed	No	N/A
<i>Ninox strenua</i>	Powerful Owl (Breeding)	2	May-Aug	Surveyed	No	N/A

Scientific Name	Common Name	Biodiversity Risk Weighting	Survey Period	Assumed to occur/survey/expert report	Present on study area	Species polygon Area or Count
<i>Pandion cristatus</i>	Eastern Osprey (Breeding)	1.5	April-Nov	Surveyed	No	N/A
<i>Petaurus norfolcensis</i>	Squirrel Glider	2	Any	Surveyed	No	N/A
<i>Phascogale tapoatafa</i>	Brush-tailed Phascogale	2	Any	Surveyed	No	N/A
<i>Planigale maculata</i>	Common Planigale	2	Any	Surveyed	No	N/A
<i>Prostanthera densa</i>	Villous Mint-bush	2	Any	Surveyed	No	N/A
<i>Rhizanthella slateri</i>	Eastern Australian Underground Orchid	3	Sept-Nov	Surveyed	No	N/A
<i>Tetradlea juncea</i>	Black-eyed Susan	2	July-Dec	Surveyed	No	N/A
<i>Tyto novaehollandiae</i>	Masked Owl (Breeding)	2	May-July	Surveyed	No	N/A
<i>Uperoleia mahonyi</i>	Mahony's Toadlet	2	Oct-March	Surveyed	No	N/A

8.5 DETERMINE PRESENCE OR ABSENCE OF A CANDIDATE SPECIES CREDIT SPECIES (STEP 4)

Targeted surveys were undertaken over the period of March 2017 to June 2018 for the candidate species credit species above to determine their presence or absence within the study area. Surveys were conducted as per the optimum survey months defined within the BAM-CC (OEH, 2018g). Where relevant guidelines were available, targeted surveys were conducted according to taxa-specific guidelines. For all other species, targeted survey was conducted in accordance with OEH Threatened Species Survey and Assessment Guidelines.

The survey effort, timing, prevailing weather conditions are summarised in Table 8.4. A figure detailing the survey effort conducted within the study area is provided in Figure 8.1. Details of the survey methodology used and results for each surveyed species are provided below. Survey methodologies for candidate species credit species have been grouped where survey effort has captured multiple species.

Table 8.4: Targeted Survey Effort

Date	Time (24hr)	Survey Effort (Expressed in Person Hours)	Activity	Weather
26-May-17	1215 - 1415	2 (two persons)	- General Site Inspection - Random Meander Flora Survey - Targeted Survey for Threatened Diurnal Birds	0/8 Cloud, 19 C, WSW 2km/h, 52% humidity
21-Jun-17	1500 - 1700	2 (two persons)	- Significant Tree Inventory - Targeted Survey for Threatened Trees	3/8 Cloud, 18.5 C, SW 18km/h, 66% humidity
	1700 - 1830	1.5 (two persons)	- Targeted Survey for Threatened Diurnal Birds - Targeted Survey for Threatened Microchiropteran Bats - Targeted Survey for Threatened Nocturnal Birds - Targeted Survey for Threatened Amphibians	7/8 Cloud, light rain, 15 C, WSW 9km/h, 82% humidity
3-Jul-17	0830 - 1600	7.5 (two persons)	- Significant Tree Inventory - Targeted Survey for Threatened Trees - Targeted Survey for Threatened Orchid - Targeted Survey for Threatened Diurnal Birds	0/8 Cloud, 7.5 C, WNW 9km/h, 97% humidity

17-Jul-17	0945 - 1400	8.5 (two persons)	Trap Deployment (Targeted Survey for Small Nocturnal Mammals)	3/8 Cloud, 11.7C, WNW 17km/h, 82% humidity
18-Jul-17	0630 - 0830	2 (one person)	Checking Traps (Targeted Survey for Small Nocturnal Mammals)	0/8 Cloud, light fog, 8.5C, NW 19km/h, 95% humidity
19-Jul-17	0645 - 0930	2 (two persons)	Checking Traps (Targeted Survey for Small Nocturnal Mammals)	0/8 Cloud, 9.3C, WNW 19km/h, 59% humidity
	1230 - 1400	6 (two persons)	Targeted Survey for Threatened Forbs and Shrubs	1/8 Cloud, 16C, W 43km/h, 43% humidity
20-Jul-17	0645 - 0930	2.75 (one person)	- Checking traps (Targeted Survey for Small Nocturnal Mammals) - Targeted Survey for Threatened Amphibians - Targeted Survey for Threatened Microchiropteran Bats	1/8 Cloud, 12.7C, SW 26km/h, 69% humidity
21-Jul-17	0645 - 1100	4.25 (one person)	- Checking Traps and Trap Retrieval (Targeted Survey for Small Nocturnal Mammals)	5/8 Cloud, 6.0C, WNW 22km/h, 74% humidity
27-Oct-17	0800-0900	1 (one person) ¹	Targeted Survey for Threatened Orchid	8/8 Cloud, 17.3C, SW 22km/h, 84% humidity

30-Oct-17	1200-1300	1 (one person)	Targeted Survey for Threatened Orchid	1/8 Cloud, 27.9C, N 22km/h, 50% humidity
30-Aug-17	0900-1300	4 (one person)	Targeted Survey for Threatened Orchid	3/8 Cloud, W 15km/h, 13.0°C on arrival. 17.0C when leaving.
21-Dec-17	0700-0900	2 (One Person)	Targeted Survey for Threatened Orchid	8/8 Cloud, 21C, E 10km/h, 87% humidity, Precipitation 7%.
23-Jan-18	0800-0930	1.5 (One Person)	- Targeted Survey for Threatened Forbs and Shrubs - Targeted Survey for Threatened Diurnal Birds	2/8 Cloud, 23.8C, NNE 6km/h, 71% humidity
27-Mar-18	1800-1900	1 (One Person)	- Targeted Survey for Threatened Amphibians - Targeted Survey for Threatened Reptiles - Targeted Survey for Small Nocturnal Mammals - Targeted Survey for Koala	8/8 Cloud, 18C, NE 6km/h, 60% humidity
23-May-18	0930-1600	6.5 hours (One Person)	Vegetation Integrity Assessment	6/8 Cloud, 14.1C, NE 9km/h, 87% humidity
29-May-18	1030-1500	5 hours (One Person)	Vegetation Integrity Assessment	6/8 Cloud, 16.5C, NNW 4km/h, 85% humidity

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14-Jun-18	1600-1900	3 (One Person)	• Vegetation Survey • Targeted Survey for Threatened Nocturnal Birds • Targeted Survey for Koala • Targeted Survey for Small Nocturnal Mammals • Targeted Survey for Threatened Microchiropteran Bats	0/8 Cloud, 13C, W 6km/h, 78% humidity
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Targeted Survey for Threatened Trees

Species Captured by Survey

- *Angophora inopina* Charmhaven Apple
- *Eucalyptus parramattensis* subsp. *decadens*
- *Eucalyptus camfieldii* Camfield's Stringybark
- *Melaleuca groveana* Grove's Paperbark
- *Syzygium paniculatum* Magenta Lilly Pilly

Survey Effort

A full significant tree inventory was undertaken for the site on 21 June, 03 July 2017 over a period of approximately 14 person hours. This survey involved searching all individual trees within the study area for significant features including hollows, nests and arboreal termite mounds, this survey also required identification of all trees to the species level by a suitably qualified ecologist. It is considered very unlikely that any threatened tree species would have been overlooked if present.

Survey Results

No threatened trees were detected during the significant tree inventory within the study area. As such, the candidate species credit species were not considered to occur within the study area.

Targeted Survey for Threatened Forbs and Shrubs

Species Captured by Survey

- *Callistemon linearifolius* Netted Bottle Brush
- *Chamaesyce psammogeton* Sand Spurge
- *Prostanthera densa* Villous Mint-bush
- *Tetradlea juncea* Black-eyed Susan

Survey Effort

A targeted survey for threatened forbs and shrubs was undertaken on the site on the 19 July and 23 January over a period of approximately 7.5 person hours. Suitable habitat for the threatened forbs and shrubs would be restricted to the vegetation zones with intact understorey and/or shrub layers within the study area. Targeted surveys were undertaken in accordance with the Guide to Surveying Threatened Plants (OEH, 2016) and involved walking parallel transects which were spaced at approximately 10m intervals across all potential habitat for the species above.

Survey Results

No threatened forbs and shrubs were detected during the targeted survey for the species above. As such these candidate species credit species were not considered to occur within the study area.

Targeted Survey for Threatened Orchids

Species Captured by Survey

- *Corybas dowlingii* Red Helmet Orchid
- *Cryptostylis hunteriana* Leafless Tongue Orchid
- *Diuris arenaria* Sand Doubletail
- *Diuris praecox* Rough Doubletail
- *Rhizanthella slateri* Eastern Australian Underground Orchid

Survey Effort

A targeted survey for threatened orchids was undertaken on the site on the 19 July and 23 January, 27 October and 30 October over a period of approximately 12 person hours. Targeted surveys were undertaken in accordance with the Guide to Surveying Threatened Plants (OEH, 2016) and involved walking parallel transects which were spaced at approximately 10m intervals across all potential habitat for the species above.

Survey Results

252 individuals of Rough Doubletail were recorded within the study area, 234 individuals were recorded within the transmission line easement (vegetation zone 1648_DNG) and 18 individuals were recorded within the coastal forest (vegetation zone 1648_Intact). This species has been assessed further within Step 5.

No other threatened orchids were detected during the targeted survey for the remainder of the species above. As such these candidate species credit species were not considered to occur within the study area.

Targeted Survey for Threatened Amphibians

Species Captured by Survey

- *Uperoleia mahonyi* Mahony's Toadlet
- *Litoria brevipalmata* Green-thighed Frog
- *Crinia tinnula* Wallum Froglet

Survey Effort

A targeted threatened amphibian survey was completed on the night of 20 July 2017 and 27 March 2018 and during the day of 21 June 2017 for a combined total of approximately 5.25 person hours.

No specific areas of likely amphibian habitat in the form of natural waterbodies or drainage lines were present within or adjacent to the study area. As such the entire study area was considered potential habitat.

The targeted surveys included a combination of diurnal and nocturnal census methods. Diurnal searches involved searches of the study area for basking or sheltering individuals. Any appropriate cover such as logs or leaf litter gathered within shallow depressions were turned over/uncovered for resting individuals.

Survey Results

No threatened amphibians were seen or heard during the survey. The only species recorded during the survey was *Limnodynastes tasmaniensis* (Spotted Marsh Frog). As such these candidate species credit species were not considered to occur within the study area.

Targeted Survey for Threatened Nocturnal Reptiles

Species Captured by Survey

- *Hoplocephalus bitorquatus* Pale-headed Snake

Survey Effort

A targeted spotlight survey for nocturnal reptiles was completed on the night of 27 for a total of approximately 1 person hour.

Targeted nocturnal searches were focused on vegetation zones with intact understorey and/or shrub layers and dense canopy layer which would provide a greater habitat value for prey (frogs, lizards and small mammals).

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken involved walking at a slow pace conducting visual searches of undergrowth and canopy for hunting reptiles and stopping every 2 minutes, allowing the observer to hear fauna movement.

Survey Results

No Pale Headed Snakes were detected during the survey. As such this candidate species credit species were not considered to occur within the study area.

Targeted Survey for Threatened Nocturnal Birds

Species Captured by Survey

- *Tyto novaehollandiae* Masked Owl (Breeding)
- *Ninox strenua* Powerful Owl (Breeding)
- *Ninox connivens* Barking Owl (Breeding)
- *Esacus magnirostris* Beach Stone-curlew (Breeding)
- *Burhinus grallarius* Bush Stone-curlew

Survey Effort

A targeted survey for nocturnal birds was completed on the evenings of 21 June 2017 and 14 June 2018 for a total of approximately 4.5 person hours.

The entire site was considered to provide potential habitat for hunting owls. Vegetation zones with intact understorey and/or shrub layers and a significant amount of coarse woody debris was considered to provide potential refuge for beach-stone and bush-stone curlews, with areas closer to the sand dunes in the south of the study area being more preferred for the beach-stone curlew.

Targeted survey for nocturnal birds involved a combination of stag watching, spotlighting and call playback. The stag watching survey for threatened owls involved watching significant hollow-bearing trees, 20 minutes prior to sunset and continuing until 20 minutes after sunset.

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken involved walking at a slow pace conducting visual searches of undergrowth and canopy for resting nocturnal birds and stopping every 2 minutes, allowing the observer to hear fauna movement.

Pre-recorded calls of Barking Owl, Powerful Owl, Masked Owl, Beach Stone-curlew and Bush Stone-curlew were broadcast through a megaphone designed to project the sound for at least 1km under still night conditions. An initial listening period of 10 minutes was undertaken, followed by 5 minutes of calls (repeated in four different directions). A period of two minutes of quiet listening was then employed after each 5-minute bracket of calls. At the conclusion of the call playback survey, spotlighting was carried out in the vicinity of the call playback site.

Survey Results

No threatened nocturnal birds were seen or heard during the survey. As such these candidate species credit species were not considered to occur within the study area

Targeted Survey for Threatened Diurnal Birds

Species Captured by Survey

- *Haliaeetus leucogaster* White-bellied Sea-Eagle (Breeding)
- *Calyptorhynchus lathami* Glossy Black-Cockatoo (Breeding)
- *Dromaius novaehollandiae* - Emu population in the New South Wales North Coast Bioregion and Port Stephens local government area
- *Callocephalon fimbriatum* Gang-gang Cockatoo (Breeding)
- *Pandion cristatus* Eastern Osprey (Breeding)

Survey Effort

A targeted survey for threatened diurnal birds was completed on the 26 May 2017, 21 June 2017 and 03 July 2017 and 23 January 2018 for a total of approximately 7.75 person hours.

Vegetation zones with an intact canopy layer which also contained large and hollow bearing remnant trees was considered to provide potential breeding habitat for hollow dependant cockatoos and eyrie building raptors. The entire study area was considered to provide potential habitat for the Emu.

The diurnal avifauna survey involved transects targeting potential habitat within the study areas of likely activity i.e. profusely flowering Eucalypts for nectivorous birds and tall canopy trees with a perspective of the ocean and other waterbodies for fishing raptors. Surveys were conducted at peak activity periods for most avifauna species (i.e. dawn and dusk). Surveys involved listening for characteristic call of targeted species and scanning potential habitat with a pair of binoculars. Incidental observations of secondary indications of presence (i.e. chewed cones and distinctive feathers) were also recorded.

In addition, full significant tree inventory was undertaken for the study area on 21 June and 03 July 2017 over a period of approximately 14 person hours. This survey would have likely identified any threatened diurnal bird species displaying notable breeding behaviour (i.e. entering and exiting hollows repeatedly or building/roosting within stick nests and eyries).

Survey Results

One individual of White-bellied Sea-eagle was identified during the targeted survey for threatened diurnal birds. This species was seen close to the ground within the easement in the south of the study area. Despite dedicated time spent observing this individual it did not displaying any behaviour to indicate that the study area may form part of this species breeding habitat (building stick nests, calling to mates or carrying prey to an eyrie) and was likely utilising the study area as a foraging resource at the time. As such, this dual ecosystem (foraging)/ species (breeding) credit species has been assessed as an ecosystem (foraging) credit species only and was not assessed further within Step 5. No other threatened diurnal birds were observed during the surveys.

Targeted Survey for Small & Medium Nocturnal Mammals

Species Captured by Survey

- *Planigale maculata* Common Planigale
- *Petaurus norfolcensis* Squirrel Glider
- *Phascogale tapoatafa* Brush-tailed Phascogale
- *Cercartetus nanus* Eastern Pygmy-possum

Survey Effort

The targeted survey for the species above involved a combination of spotlighting and small - medium mammal trapping

Vegetation zones with an intact canopy layer which also contained large and hollow bearing remnant trees over a relatively dense strata of shrub and understorey species were considered to provide more likely habitat for the species above.

Spotlighting was undertaken on foot using 100watt hand-held spotlights. The spotlighting undertaken involved walking at a slow pace conducting visual searches of undergrowth and canopy for foraging nocturnal mammals and stopping every 2 minutes, allowing the observer to hear fauna movement. Spotlighting was undertaken on 27 March 2018 and 14 June 2018 for a total of approximately 4 person hours.

Small terrestrial mammal trapping was undertaken using 30 Elliott Type A traps (8x10x33cm) within the study area in July 2017. The traps were left in place for four consecutive nights giving a total of 120 small terrestrial trap nights. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse. The northern portion of the study area was excluded from the small terrestrial mammal survey due to the absence of understorey vegetation from recent underscrubbing, which would have resulted in any fauna caught being left exposed overnight. The baits used for the traps were a mixture of rolled oats and honey, Good-O's (dry dog food) and peanut butter. The traps were checked early each morning and, where necessary, reset and rebaited.

Medium terrestrial mammal trapping was undertaken using 6 cage traps (60x35x40cm) within the study area in July 2017. The traps were left in place for four consecutive nights giving a total of 24 medium terrestrial trap nights. The traps were hidden in thick grass, under shrubs or near fallen logs and were camouflaged with vegetation where the ground cover was sparse. The bait used for the traps were raw chicken necks. The traps were checked early each morning and, where necessary, reset and rebaited.

Arboreal mammal trapping was undertaken using 12 Elliott Type B traps (15 × 15 × 46cm) and 4 PVC Pipe traps within the study area in July 2017 to determine the presence of arboreal mammals, particularly *Petaurus norfolcensis* (Squirrel Glider) which is known to occur in similar habitats in the local area (OEH, 2017). The traps were left in place for four consecutive nights giving a total of 64 arboreal trap nights. The traps were placed around 3 - 4 metres above the ground on platforms mounted on tree trunks. The targeted trees contained hollows, were flowering or had scratches present on the boles. The baits used consisted of a rolled oats and honey mixture, peanut butter and liquorice pieces. The traps were sprayed with honey mixed in water before being placed in the trees to attract fauna and mask the smell of humans. The tree trunks were also sprayed with this mixture each day. In all cases the traps were checked early each morning and, where necessary, reset and rebaited.

Survey Results

The results of the small terrestrial mammal survey are shown in Table 8.5. Trap locations are displayed in Figure 8.1

Table 8.5: Trapping Results.

Date	Trap No	Species	Sex
Small Terrestrial Mammal Trapping			
Tuesday 18/07/17	T1	<i>Antechinus stuartii</i> (Brown Antechinus)	Male
	T7	<i>A. stuartii</i>	Male
	T11	<i>A. stuartii</i>	Male
	T12	<i>A. stuartii</i>	Male
	T19	<i>A. stuartii</i>	Male
	T29	<i>A. stuartii</i>	Male
Wednesday 19/07/17	T1	<i>A. stuartii</i>	Male
	T7	<i>A. stuartii</i>	Male
	T10	<i>A. stuartii</i>	Male
	T12	<i>A. stuartii</i>	Male
	T14	<i>A. stuartii</i>	Male
	T17	<i>A. stuartii</i>	Female
	T18	<i>A. stuartii</i>	Male
	T20	<i>A. stuartii</i>	Male
	T22	<i>A. stuartii</i>	Female
	T27	<i>A. stuartii</i>	Female
	T29	<i>A. stuartii</i>	Male
	T30	<i>A. stuartii</i>	Male
Thursday 20/07/17	T1	<i>A. stuartii</i>	Male
	T4	<i>A. stuartii</i>	Male
	T10	<i>A. stuartii</i>	Male
	T15	<i>A. stuartii</i>	Female
	T18	<i>A. stuartii</i>	Male
	T21	<i>A. stuartii</i>	Male
	T25	<i>A. stuartii</i>	Female
	T30	<i>A. stuartii</i>	Male
Friday 21/07/17	T1	<i>A. stuartii</i>	Male
	T5	<i>A. stuartii</i>	Male
	T10	<i>Rattus rattus</i> (Black Rat)	Female
	T12	<i>A. stuartii</i>	Male
	T14	<i>A. stuartii</i>	Male
	T15	<i>A. stuartii</i>	Male
	T19	<i>A. stuartii</i>	Male
	T27	<i>A. stuartii</i>	Female
	T29	<i>A. stuartii</i>	Male
	T30	<i>A. stuartii</i>	Female
Medium Terrestrial Mammal Trapping			
Tuesday 18/07/17	N/A	No captures	N/A
Wednesday 19/07/17	N/A	No captures	N/A
Thursday 20/07/17	N/A	No captures	N/A
Friday 21/07/17	C1	<i>Isodon macrourus</i> (Northern Brown Bandicoot)	Undetermined
Arboreal Mammal Trapping			
Tuesday 18/07/17	A15	<i>Antechinus stuartii</i> (Brown Antechinus)	Female
Wednesday 19/07/17	A1	<i>A. stuartii</i>	Male
	A7	<i>A. stuartii</i>	Male
	A15	<i>A. stuartii</i>	Male
Thursday 20/07/17	A15	<i>A. stuartii</i>	Male
Friday	A7	<i>A. stuartii</i>	Female

Date	Trap No	Species	Sex
21/07/17			

No threatened small or medium nocturnal mammals were observed or trapped during the survey. As such these candidate species credit species were not considered to occur within the study area.

Targeted Survey for Koala Breeding Habitat

Survey Effort

A targeted Koala survey was completed on the night of 27 March 2018 and 14 June 2018 and during the day of 21 June 2017 and 03 July 2017 for a combined total of approximately 19 person hours.

No preferred Koala feed trees were present within the study area, thus all areas within the study area containing an intact canopy layer was considered potential habitat

Surveys for the Koala involved both direct observation during spotlighting and call-playback surveys and indirect observation methods during diurnal significant tree inventory consistent with the EPBC Act Referral Guidelines for the Vulnerable Koala (Department of the Environment, 2014).

Direct observation involved spotlighting using 100 watt hand-held spotlights. The spotlighting undertaken involved walking at a slow pace conducting visual searches of undergrowth and canopy for foraging nocturnal mammals and stopping every 2 minutes, allowing the observer to hear fauna movement. Pre-recorded calls of the Koala were broadcast through a megaphone, within the centre of the study area, to project the sound for at least 1km under still night conditions. An initial listening period of 10 minutes was undertaken, followed by 5 minutes of calls (repeated in four different directions). A period of two minutes of quiet listening was then employed after each 5-minute bracket of calls. At the conclusion of the call playback survey, spotlighting was carried out in the vicinity of the call playback study area.

Indirect survey techniques involved searches for scratches on tree trunks and also searches for scats, this was undertaken concurrently with a full significant tree inventory across the study area, checking all trees present for significant attributes and habitat features. It is considered very unlikely that any evidence of Koala would have been overlooked if present.

Survey Results

No Koalas were detected during the survey. As such this candidate species credit species were not considered to occur within the study area

Targeted Survey for Threatened Microchiropteran Bats

Survey Effort

A targeted microchiropteran bat survey was completed on the nights of 21 June 2017, 20 July 2017 and 14 June 2018, for a combined total of 7.25 hours.

All vegetation zones within the study area were considered to provide potential hunting habitat for microchiropteran bats.

Surveys for microchiropteran bats involved using a handheld Anabat Bat echo-location device to survey for species specific hunting pulses created by microbats. Echolocation surveys used a combination of stationary and hand held mobile surveys. Mobile surveys within the study area targeted microhabitats of potentially increased bat activity including flyways, clearings and ecotones and were conducted over two nights. Stationary call activated microchiropteran bat detection was undertaken from dusk to dawn for one night.

Survey Results

Two microchiropteran bat species were recorded during the survey *Miniopterus australis* (Little Bentwing Bat) and *Vespadelus* sp. which could only be identified to the genus level. One species of threatened microbat within the genus *Vespadelus*, *Vespadelus troughtoni* was generated by the BAM-CC as having potential to occur within the study area, thus a conservative approach was adopted and this species was given consideration as occurring within the study area.

Both of the species credit species above have habitat constraints of caves or other significant refuge/breeding features both on a landscape and study area level. In addition, both of these species credit species have large foraging ranges and it is likely that the study area could be within a foraging area for these species yet not contain significant habitat constraints. As such the occurrence of this species was not considered to trigger the requirement for species credit generation and was not assessed further within Step 5. No other microbat species were recorded during the surveys.

8.6 DETERMINE THE AREA OR COUNT, AND LOCATION OF SUITABLE HABITAT FOR A SPECIES CREDIT SPECIES (STEP 5)

One threatened orchid, Rough Doubletail, was confirmed through survey as present within the study area. A description of the ecology of this species, its defined habitat constraint and the approach used to estimate a species polygon for this species has been provided in Table 8.6 below. The species polygon for this species is mapped in Figure 8.2.



Author	BE
Reviewer	DH
Job Ref	12287
A4 Scale	1:2,500



0 50 100 m



Map Projection GDA94 MGA Zone 56

Figure B.2
Species Polygon Map
Lot 591 DP 1191380 Anna Bay, NSW
19 June 2018

Table 8.6: Rough Doubletail Species Credit Species Polygon

<i>Diuris praecox</i> (Rough Doubletail) BC Act - Vulnerable EPBC Act - Vulnerable	
Description	Terrestrial orchid with two or three linear leaves, flowers nodding, yellow with a few dark brown markings at the base of the dorsal sepal and labellum. Petals obliquely erect, widely divergent, curved backwards; lamina narrow-elliptic to ovate.
Habitat and Distribution	This species is known from between Bateau Bay and Smiths Lake. Grows on hills and slopes of near-coastal districts in open forests which have a grassy to fairly dense understorey. Exists as subterranean tubers most of the year. It produces leaves and flowering stems in winter.
Biodiversity Concern/risk Weighting	Moderate Biodiversity Concern Risk weighting - 1.50
Method used to Confirm Presence	Targeted Survey
Number and location of individuals recorded	234 individuals within Vegetation Zone 1648_DNG 18 individuals within Vegetation Zone 1648_Intact
Defined Habitat Constraints	N/A
Species Polygon Unit of Measure	Area
SAII Entity	No
Approach used to define species polygon boundary	In accordance with Section 6.4.1.28 of the BAM the species polygon for fauna species, and flora species where the unit of measure is area, according to the TBDC, the species polygon is used to measure the area and location of suitable habitat. Although this species was only identified within a two vegetation zones comprised of derived native grassland and intact coastal forest its habitat as defined within the TSBDC includes open forests which have a grassy to fairly dense understorey which would be inclusive of all vegetation zones containing native vegetation within the study area. Thus the species polygon for Rough Doubletail has been extended to include the entirety of Vegetation Zones: • 1648_Intact • 1648_Modified Understorey • 1648_DNG Which encompasses a total area of 11.42 ha.
Example of Rough Doubletail within the study area 	

8.7 DETERMINE THE HABITAT CONDITION WITHIN THE SPECIES POLYGON FOR SPECIES ASSESSED BY AREA (STEP 6)

In accordance with Section 6.4.1.35 of the BAM the following table details the habitat condition of each species polygon by using the vegetation integrity score for each vegetation zone that is within the species polygon (Table 8.7).

Table 8.7: Habitat Condition for Species Polygon

Species	Vegetation Zones within Species Polygon			
	1648_Intact Vegetation Integrity Score	1648_Modified Understorey Vegetation Score Integrity	1648_DNG Vegetation Integrity Score	1204_Sparse Vegetation Integrity Score
<i>Diuris praecox</i> (Rough Doubletail)	62.5	56.1	31.2	Vegetation zone not within Species polygon

STAGE 2 - IMPACT ASSESSMENT

This Section identifies the potential impacts of the proposed development on the biodiversity values of the study area, methods of avoidance and minimisation of impacts and a revaluation of potential impacts when considering avoidance and minimisation strategies.

9.0 ACTIONS TO AVOID/MINIMISE PROJECT IMPACTS

Although the proposed development is associated with the bulk extraction of sand from Stockton Sandspit it is anticipated that direct impacts to biodiversity values within the study area will be primarily restricted to the vegetation removal required for the development of ancillary structures and civil works, as detailed within Section 1.2

The principal means to reduce impacts on biodiversity within the study area has been to avoid and minimise removal of native vegetation and fauna habitat and to avoid the direct loss of significant biodiversity values and threatened matters. The potential impacts resulting from the proposed development have broken down into three phases of activity: site selection and planning, construction and operation. Measures taken to date to avoid and minimise impacts have been summarised and recommendations to assist the proponent to design a development that further avoids and minimises are provided.

9.1 PLANNING AND DETAILED DESIGN

The proponent has considered biodiversity values present within the study area and sought advice from Wildthing in the planning and detailed design stages of the development layout to avoid, where possible, direct impacts to identified biodiversity values. The current development layout has been selected, in part, to minimise impacts to significant biodiversity values, threatened matters and flora and fauna habitats present within the broader study area.

The presence of the threatened flora species, Rough Doubletail within the study area has affected the final detailed design of the ancillary facilities within the study area (site managers shed and associated APZ). During the conceptual design phase for the proposed development, the ancillary facilities were planned to be located closer to the sand extraction operations area directly adjacent to the north of the Ausgrid easement. A preliminary ecological constraints analysis was conducted by Wildthing during initial scoping of fieldwork, it was determined that a large population of Rough Doubletail was present within the easement. Accordingly, the final development layout was revised, the site manager's shed and associated APZ is now proposed for location within the east of the study area, its revised location contains fewer biodiversity values.

All direct impacts to the area containing the Rough Doubletail have been avoided as has the loss of a significant concentration of hollow-bearing trees present within the southern section of the study area.

The final layout and location of the ancillary structure has not been able to completely avoid all biodiversity values, one hollow bearing tree within the shed footprint will require removal and, in addition, one hollow-bearing tree may require removal for the establishment of an APZ.

Access to the sand dunes within the south of the study area will be required for heavy reticulated vehicles and plant machinery to export sand from the study area. Minimisation of the clearance of native vegetation required for vehicle access was considered during the detailed design phase of the development and use of the pre-existing dirt access track running north-south through the study area has been maximised, where feasible, to facilitate vehicle movement. A small section of realignment will be required to allow for the turning circle required for reticulated vehicles and also to allow the space necessary for the relocation of the ancillary facilities within the east of the study area. No further recommendations of avoidance/minimisation were relevant to this phase of the development. Assessment of the residual impact from the layout has been assessed within Section 10.

9.2 CONSTRUCTION

Construction for the proposed development will require removal of native vegetation in support of the installation of ancillary facilities including the managers shed within the east of the study area. Construction of the site managers shed will also require the establishment of an associated asset protection zone with a radius of approximately 35m from the edge of the building footprint (See Figure 1.2).

During the detailed design phase of the proposed development a final quantitative measure of vegetation removal for the APZ could not be confirmed due to uncertainties regarding the final canopy cover to be retained. Although it is likely that a significant amount of the canopy within this area will be retained, a conservative approach has been adopted and all trees within the APZ have been considered likely to be removed and have been included within the residual impact assessment in Section 10.

A table defining recommendations for further avoidance and minimisation strategies during the construction phase have been detailed below (Table 9.1). The residual impact predicted to occur after considering the avoidance and minimisation strategy above has been detailed within Section 10.

Table 9.1: Further avoidance and minimisation strategies for the construction phase

Nature of Potential Impact	Avoidance/minimisation Strategy Proposed	Timing	Responsibility
Clearing of native vegetation	Where possible, construction works should avoid any impact to mature trees. Where unavoidable, works should minimise impacts to mature trees as follows: - clearing limits will be clearly marked to prevent unnecessary clearing beyond the extent of the development footprint. Tree clearing and disturbance will be limited to the development site; - where a tree must be disturbed the priority should be given to pruning rather than clearing; and	Prior to and during vegetation clearing	Construction site manager

	the clearing of any trees should be undertaken in a manner that avoids damaging adjacent vegetation i.e. all trees should be felled into disturbed areas when feasible.		
Inadvertent impact to biodiversity values	Priority will be given during construction to avoid any inadvertent impact to significant biodiversity values within the study area. Avoidance measure should include the following: - appropriate signage, such as 'No Go Zone' or 'Environmental Protection Area', and exclusion fencing where relevant, should be installed where construction and operation is near significant biodiversity values i.e. location of Rough Doubletail population; - the location and significance of all ecological constraints within the study area should be made known to all contractors and staff. Annotated site plans should be displayed in lunch room / site offices. Specific management measures required near constraints areas should be discussed in tool box talks and as part of all induction; - all material stockpiles, vehicle parking and machinery storage will be located within cleared areas proposed for clearing, and not in areas of native vegetation that are to be retained; - establishment of wet down areas to reduce dust generation during construction; - implementation of temporary stormwater controls during construction and to ensure that discharges to the drainage channels are consistent with existing conditions; and - temporary erosion and sediment controls (e.g. silt fences, sediment traps) should be installed prior to construction to avoid disturbance and degradation of soils and nearby features (e.g. water ways, adjacent habitat and vegetation). These should conform to the specifications in Soils and Construction 'Blue Book' (Landcom, 2004) and should be maintained throughout the construction process until soil is successfully stabilised.	Prior to and during vegetation clearing	Construction site manager
Clearing of fauna habitat, resulting in fauna injury and/or mortality	A suitably qualified and experienced ecologist should be engaged to supervise removal of all significant habitat features as displayed in Figure 8.1 and maintain a vegetation clearance register which should include the location, type, size of felled habitat trees and any contact with resident fauna. The supervising ecologist will work co-operatively with the plant operator to develop an adaptive clearance methodology that should minimise impacts to potential resident fauna whilst being conducted according to safe work methods. The adaptive clearance methodology should include the following key aspects:	Prior to and during vegetation clearing	Construction site manager and suitably trained fauna handler

	• seeking consultation with a suitably qualified ecologist to determine the best time to schedule clearance works to avoid nesting and breeding times for resident fauna; • preclearance surveys completed on the morning of any clearance works to determine if any nesting birds or canopy dwelling mammals are within the clearance footprint; • clearing utilising a 'soft felling' technique in which trees are 'nudged' by machinery and fauna given time to leave (overnight), before slowly felling the tree the following day; • if fauna is identified within the proposed clearing area prior to clearing, or after 'nudging' the tree, operations will cease until the fauna has moved to a safe location or has been relocated. If fauna flee into a habitat tree demarcated for removal this tree should also be nudged and left to fell until the following day; • any captured displaced fauna relocated to the nearest area of appropriate habitat. If arboreal, the fauna to be placed inside an artificial nest box and relocated. If the displaced fauna is nocturnal relocation to occur during dusk; and • all hollow logs and felled trees would be inspected by the ecologist before relocation into areas of similar adjacent habitat All habitat tree felling activities and results to be summarised in a tree clearance report by the supervising ecologist, including fauna injuries. Any animals injured during construction should be taken immediately to the Salamander Bay Veterinary Clinic (Open 9am-6pm weekdays) for treatment. Any animals suspected to require rehabilitation would be delivered post-veterinary care to an appropriate animal rehabilitator associated with Wildlife in Need of Care (phone # 1300 946 295). All fauna sightings/captures would be recorded and uploaded to the NSW Wildlife Atlas.		
Salvage of significant habitat features	Habitat salvage within the development footprint should be undertaken prior to and during clearance activities, with the salvage methodology including the following key aspect: • Tree limbs containing natural hollows should be relocated and restored for use by fauna in the nearest adjacent area of similar habitat by a suitably qualified ecologist. Where natural hollows cannot be relocated, an artificial nest box should be installed onto a tree in the nearest adjacent area of similar habitat by a suitably qualified ecologist. Installation of nest boxes should be undertaken in accordance with Part B1 of Port Stephens Councils Development Control Plan (Port Stephens Council 2014).	Prior to and during vegetation clearing	Construction site manager and suitably trained fauna handler

	Where removal of woody debris is required: • dead trees and woody debris that are removed (diameter >10 cm) to be placed in the nearest adjacent area of similar habitat by a suitably qualified ecologist.		
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9.3 OPERATION

The operational effects of the proposed development will primarily be restricted to the sand extraction process within the south of the study area and the associated entry/egress of reticulated vehicles and plant machinery via Nelson Bay Road. Initially, the extraction of sand will be restricted to the area of Stockton Sand Dunes that has encroached into the study area (approximately 1 ha), as displayed in Figure 1.2. This area is primarily composed of bare Aeolian sand with a small amount of native vegetation which has a low structure, function and composition score (see Table 6.2).

The sand material to be mined is transgressive by nature and its extent is constantly changing according to prevailing winds buffeting the study area from the south. It is expected, based upon previous observations made by the proponent that the dunes to the east and west of the current sand incursion area will advance over time eventually encompassing all native vegetation present to the south of the Ausgrid easement. If this is to occur the proponent will extend sand extraction operations to include this area. Before this occurs, the proponent should contract a BAM accredited assessor to re-evaluate the current coastal forest areas south of the Ausgrid easement to determine if sand incursion has occurred to a degree where the coastal forest does not support significant function, composition and structure scores.

A table defining recommendations for further avoidance and minimisation strategies during the operation phase has been detailed below (Table 9.2). The residual impact predicted to occur after considering the avoidance and minimisation strategy above has been detailed within Section 10.

Table 9.2: Further avoidance and minimisation strategies for the operation phase

Nature of Potential Impact	Avoidance/minimisation Strategy Proposed	Timing	Responsibility
Avoiding operational impacts on flora and fauna	Measures to reduce impact to resident fauna and flora within the study area during the operations phase should be implemented including: • vehicle movement within the study area to be restricted to operational hours of 9am-5pm Monday-Friday; • vehicle speed within the study area to be limited according to adjacent habitat value and road condition (e.g. 10km/hr); • no workers to be permitted to bring dogs onto the site; • all food waste to be disposed of in covered waste bins; and • a register of all disturbances to fauna caused during site operations to be kept and updated by the site manager, In addition, measures to supply further protection from operation impacts to the Rough Doubletail population within the Ausgrid easement should be considered, this could be	For life of operational phase	Site Manager

	inclusive of permanent exclusion fencing, sedimentation barriers and spill management controls. All measures to further protect this population would be sought in consultation with Ausgrid who maintain ownership and responsibility for the easement and require periodic access for maintenance works.		
Assisting injured fauna	Any animals injured during operations should be taken immediately to the Salamander Bay Veterinary Clinic (Open 9am-6pm weekdays) for treatment. Any animals suspected to require rehabilitation would be delivered post-veterinary care to an appropriate animal rehabilitator associated with Wildlife in Need of Care Phone 1300 946 295).	For life of operational phase	Site Manager
Minimise weed infestations	The following measures should be implemented to prevent exotic plant material from entering/exiting the study area: - no imported/exported material to be permitted unless it has been inspected and confirmed to be free of dirt and mud which may contain weed seeds and vegetative material such as bulbs, root fragment, tubers or rhizomes; and - vehicles and machinery to be clean of soils, vegetation and seeds that have been brushed off or washed down prior to entering the study area - A clean down register to be maintained at the entry of the study area	For life of operational phase	Site Manager
Treat existing weed infestations	All employees and sub-contractors working within the study area should be educated on the identification of noxious weed species known to occur or with potential to occur during site specific induction. A protocol of reporting and mapping any sightings of these species would be developed by the site manager. As a part of maintenance within the study area any high threat weeds known to occur will be controlled in accordance with appropriate DPI guidelines. Guidelines for the treatment of high threat weeds can be sourced within the DPI website (DPI, 2018).	For life of operational phase	Site Manager
Prevention of excessive dust	Unsealed access roads and operational areas should be regularly watered to limit dust generation, particularly in windy conditions.	For life of operational phase	Site Manager
Reduce impacts of artificial lighting	Any artificial lighting used for security at night should be angled/directed downwards to avoid excessive light pollution affecting adjacent habitat.	For life of operational phase	Site Manager

10 ASSESSMENT OF RESIDUAL IMPACTS

In accordance with Section 9 of the BAM this section provides assessment of the extent of the residual impacts unable to be feasibly avoided and an assessment of the likelihood of residual indirect impacts which may occur after considering the feasibility of avoidance and minimisation strategies proposed within Section 9.

10.1 DIRECT RESIDUAL IMPACTS

The construction phases of the proposal have the potential to directly impact biodiversity values. This would occur through impacts such as vegetation clearance in support of the installation of ancillary facilities and the loss of individual habitat trees. These impacts will be permanent and will occur from the outset of the development works. Mitigation measures outlined in Section 9 above will help to minimise the potential impacts to biodiversity values that remain present within the study area.

The direct impacts arising from the project include:

- the removal of 0.22 ha of Vegetation Zone 1648_DNG
- the removal of 0.59 ha of Vegetation Zone 1648_Intact
- the removal of 0.11 ha of Vegetation Zone 1204_Sparse
- the potential removal of 2 hollow-bearing trees within Vegetation Zone 1648_Intact
- the removal of threatened species habitat, including the removal of 0.81 ha of suitable habitat for the species credit species Rough Doubletail

10.2 INDIRECT RESIDUAL IMPACTS

Indirect impacts occur when the proposal or activities relating to the construction or operation of the proposal affect native vegetation, threatened ecological communities and threatened species habitat beyond the study area. Impacts may also result from changes to land-use patterns. Table 10.1 provides an assessment of the potential indirect residual impacts on the study area and adjacent vegetation in accordance with Section 9.1.4.2 of the BAM.

Table 10.1: Indirect Impact Assessment

Indirect Impact	Assessment/ Likelihood of Occurrence
Inadvertent impacts on adjacent habitat or vegetation	The proposed development has the potential to result in inadvertent impacts on adjacent retained habitat or vegetation. However, the mitigation measures described above will minimise the likelihood of occurrence of this indirect impact during the construction phase of the project.
Reduced viability of adjacent habitat due to edge effects	The proposed development will not result in a significant increase in edge effects impacting upon the retained vegetation. The majority of the site has been historically disturbed and as such edge effects have been an ongoing impact to the retained vegetation within the study area. The proposed development will increase edge effects to a small portion of the vegetation present in the southern and eastern corners

	of the study area. This vegetation is currently disturbed and will remain connected to other areas of higher condition vegetation and as such any increased edge effects are expected only to result in negligible impacts.
Reduced viability of adjacent habitat due to noise, dust or light spill	The proposed development has the potential to result in impact to fauna habitat due to noise, dust and light spill. However, the mitigation measures described above will minimise the likelihood of occurrence of this indirect impact during the construction and operational phase of the project. An air quality impact assessment has been conducted to assess the cumulative impacts of the sand extraction activity during the operations phase (Advitech 2018).
Transport of weeds and pathogens from the site to adjacent vegetation	The proposed development has the potential to result in an increase of weed spread within the study area and adjacent vegetation. However, the mitigation measures described above will minimise the likelihood of occurrence of this indirect impact during the construction and operation phase of the project.
Increased risk of starvation, exposure and loss of shade or shelter	This is unlikely to occur as the proposed development will not substantially modify vegetation within the study area or surrounding habitat such that a significant loss in foraging, hunting and shelter resources would occur.
Loss of breeding habitats	Two hollow-bearing trees were recorded within the development footprint and both could potentially require removal as a result of the proposed development. However, the mitigation measures described above will ensure that no net loss of hollows will result from the proposed development.
Trampling of threatened flora species	The proposed development has the potential to result in inadvertent impacts to a population of Rough Doubletail within the study area via inadvertent trampling. A method for ensuring the protection of this population i.e. appropriate signage and exclusion fencing, should be sought by the client in consultation with Ausgrid.
Inhibition of nitrogen fixation and increased soil salinity	The proposed development will not result in the removal of a substantial area of native vegetation, there are also large patches of vegetation, both within and adjacent to the study area, that will not be impacted. As such it is not considered likely that nitrogen fixation or soil salinity will be impacted.
Fertiliser drift	No fertiliser is proposed to be used.
Rubbish dumping	Mitigation measures outlined above and standard construction environmental controls will ensure potential impact from rubbish dumping is minimised.
Wood collection	The proposed development is industrial in nature and it is considered unlikely those persons who will work at the site will collect wood from the retained vegetation.
Bush rock removal and disturbance	The sandy soil present within the study area does not support bush rock.
Increase in predatory species populations	There is no proposed change to land use that will likely lead to an increase in predatory species populations
Increase in pest animal populations	There is no proposed change to land use that will likely lead to an increase in pest animal populations.
Increased risk of fire	There is no proposed change to land use that will likely lead to an increased risk of fire.
Disturbance to specialist breeding and foraging habitat, e.g. Beach nesting for shorebirds	No specialist breeding habitat occurs within the study area. A number of shorebirds are likely to utilise Stockton Sand Dunes for both foraging and nesting,

	however no shorebird species have been recorded within the sand dunes likely to be affected both directly and indirectly by the operational phase of the proposed development.
Fragmentation of movement corridor.	As outlined in Figure 3.1 and Section 3.5 of this report, vegetation to be removed within the study area comprises the eastern extent of a key green corridor and regionally significant habitat linkage, linking habitats surrounding the study area and across the greater landscape from the Watagans and Yengo National Parks to the coastal plains of the Tomago Sand beds, Stockton Bight and Port Stephens. As a worst case scenario, within the study area, the width of the vegetated corridor will be reduced, as a result of the proposed development, from approximately 550m to 450m wide. This is not considered likely to result in substantial or significant adverse impedance to mobile fauna species and some flora species that may use the vegetation within the study area corridor for dispersal. Large areas of vegetation, present in similar ecological condition, will be retained maintaining the corridor at, or just below, its current functionality. Direct impacts to this movement corridor (removal of 0.81 hectares of vegetation at the southern boundary of the corridor) are considered incremental and minor when being considered at the landscape scale. Indirect impact to this corridor from the proposed development would be primarily restricted to a potential increase in vehicle strikes of fauna arising from increased heavy vehicle movement within the study area. However, the mitigation measures described above will minimise the likelihood of occurrence of this indirect impact during the construction phase of the project

10.3 PRESCRIBED IMPACTS

Prescribed impacts are the impacts on biodiversity values which are not related to, or are in addition to, native vegetation clearing and habitat loss (Section 6.7 of the BAM). In general, these types of impacts identify habitat or features of the environment that are irreplaceable. Assessment of prescribed biodiversity impacts are outlined and addressed in Table 10.2 below.

Table 10.2 Prescribed Impacts Assessment

Prescribed impact	Assessment / likelihood of occurrence
Impacts of development on the habitat of threatened species or ecological communities associated with karst, caves, crevices, cliffs and other features of geological significance.	No karst, caves, crevices, cliffs and other features of geological significance will be impacted by the proposed works.
Impacts of development on the habitat of threatened species or ecological communities associated with rocks.	No significant clusters of rocks were present within the study area.

Prescribed impact	Assessment / likelihood of occurrence
Impacts of development on the habitat of threatened species or ecological communities associated with human made structures.	No human made structures will be impacted by the proposed works.
Impacts of development on the habitat of threatened species or ecological communities associated with non-native vegetation.	An area of non-native vegetation was recorded within the north of study area in the form of maintained introduced grass and a small amount of exotic trees and shrubs. No threatened species that rely on this non-native vegetation as a habitat resources were recorded or predicted to occur within the study area during the assessment.
Impacts of development on the connectivity of different areas of habitat of threatened species that facilitates the movement of those species across their range.	As outlined in Table 10.1, vegetation to be removed within the study area comprises the eastern extent of a key green corridor and regionally significant habitat linkage, linking habitats surrounding the study. In line with the assessment within Table 10.1, the small amount of vegetation removal proposed is not considered likely to result in substantial or significant adverse impedance to mobile fauna species and some flora species that may use the vegetation within the study area corridor for dispersal.
Impacts of the development on movement of threatened species that maintains their life cycle	A number of threatened species are likely to utilize the vegetation within the study area however the movement of threatened species throughout the study area is not expected to be adversely affected given the recommendations of avoidance and minimisation of impacts within Section 9.
Impacts of development on water quality, water bodies and hydrological processes that sustain threatened species and threatened ecological communities (including subsidence or upsidence resulting from underground mining or other development)	No waterbodies or waterways were present within the study area. In addition, no aquifers or ground water dependant ecosystems were mapped within the study area (BoM 2018) nor would the operational effects of the proposed development require penetration of an aquifer.
Impacts of wind turbine strikes on protected animals	N/A
Impacts of vehicle strikes on threatened species of animals or on animals that are part of a TEC	Vehicle strikes on threatened species have the potential to occur within the construction and operational phase of the development. Methods to avoid potential occurrences of vehicle strike on threatened species have been detailed within Section 9.

10.4 IMPACTS TO GROUNDWATER DEPENDENT ECOSYSTEMS

The study area is not mapped as being a ground water dependant ecosystem (BoM 2018) or associated with a known aquifer.

The NSW DPI step by step guide for assessing a proposal against the NSW Aquifer Interference Policy states: *If an activity is not defined as an aquifer inference activity, then assessment is not required under the Aquifer Interference Policy.*

The Water Management Act defines an aquifer interference activity as an activity involving any of the following:

- The penetration of an aquifer.
- The interference with water in an aquifer.
- The obstruction of the flow of water in an aquifer.
- The taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations., and/or the disposal of that water.

The proposed development is not associated with any mapped Groundwater Dependent Ecosystems (GDEs), nor will it require significant subsurface penetration or aquifer interference activity and as such, will not impact upon GDEs.

10.5 SERIOUS AND IRREVERSIBLE IMPACTS (SAII)

The principles used to determine if a development will have serious and irreversible impacts, include impacts that:

- Will cause a further decline of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to be in a rapid rate of decline, or
- Will further reduce the population size of the species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very small population size, or
- Impact on the habitat of a species or ecological community that is currently observed, estimated, inferred, or reasonably suspected to have a very limited geographic distribution, or
- Impact on a species or ecological community that is unlikely to respond to measures to improve habitat and vegetation integrity and is therefore irreplaceable.

No threatened matter consistent with a SAII candidate species identified as likely to occur or to contain significant habitat within the study area is likely to be impacted by the proposed development

10.6 ADAPTIVE MANAGEMENT STRATEGY

No adaptive management strategy is proposed for the development.

11 BIODIVERSITY CREDITS

This section outlines the thresholds for assessment and offsetting in accordance with Section 10 of the BAM.

11.1 IMPACTS ON VEGETATION ZONES NOT REQUIRING OFFSETS

A 0.11ha area of maritime grassland associated with vegetation zone 1204_Sparse (Vegetation Integrity Score - 0.6) was present within the sand dune incursion within the south of the study area and will require complete removal during sand extraction operations. As outlined in Section 10.3.1 of the BAM, offset credit value under the BOS is required to be determined for all impacts of development on vegetation zones that have a vegetation integrity score of:

- ≥ 15 where the PCT is representative of an endangered or critically endangered ecological community, or
- ≥ 17 where the PCT is associated with threatened species habitat (as represented by ecosystem credits), or is representative of a vulnerable ecological community, or
- ≥ 20 where the PCT is not representative of a TEC or associated with threatened species habitat.

Vegetation zone 1204_Sparse is not a TEC, however it could potentially provide habitat for threatened species. As such, with a vegetation integrity score of 0.6 (ie. ≤ 17), offsets are not required for impact to this vegetation zone.

11.2 IMPACTS REQUIRING OFFSETS

The following Sections provide a breakdown of the credit requirement for the proposed development in accordance with Section 10 of the BAM.

Ecosystem Credits

The PCTs and vegetation zones requiring offset and the ecosystem credits required are documented in Table 11.1.

Table 11.1 Ecosystem Credits Required for Offsetting

Vegetation Zone	Total Area	Area Proposed for Removal	Current Vegetation Integrity Score	Change in Vegetation Integrity Score	Loss of Hollow Bearing Trees	Ecosystem Credits Required
1648 - Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula						
1648_ModifiedUnderstorey	4.56	0	56.1	0	0	0
1648_DNG	1.12	0.22	31.2	-6.1	0	3
1648_Intact	5.74	0.59	62.5	-6.4	2	16
				Total	2	19
1204 - Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion						
1204_Sparse	0.11	0.11	0.6	-0.6	0	0
				Total	0	0

Species credits

An offset is required for the threatened species impacted by the development that require species credits. These species and the species credits required are documented in Table 11.2.

Table 11-2 Species credit species that require offsets

Species credit Species	Biodiversity Risk Weighting	Area of habitat or count of individuals lost	Species credits required
<i>Diuris praecox</i> (Rough Doubletail)	1.5	0.81 ha	17

A total of the offsets credits required to be retired, as generated by the BAM-CC, has been provided in Appendix D of this report.

11.3 OFFSETS REQUIRED UNDER THE EPBC ACT

Offsetting requirements for potential impacts to suitable habitat for the nationally listed species *Diuris praecox* (Rough Doubletail) have been addressed under state legislation and thus are not considered to be warranted under federal legislative frameworks. No other species listed under the EPBC Act has been identified as having the potential to be significantly impacted by the development. As such, the proposal is not considered to require offsets in accordance with the EPBC Offsets Policy.

12 CONCLUSION

Wildthing Environmental Consultants have prepared this BDAR on behalf of the proponent for a proposed sand mine in Anna Bay, NSW. The purpose of this BDAR was to address the requirements of the BAM and to address the biodiversity matters raised in the SEARs.

In this BDAR, biodiversity impacts have been assessed through:

- Comprehensive mapping and assessment completed in accordance with the BAM
- The identification of a threatened species of flora within the development site, the impacts to which have been adequately assessed
- Mitigation measures which have been outlined to reduce the impacts to biodiversity
- The generation of 19 Ecosystem Credits within the development site for impacts to native vegetation and the generation of 14 Species Credits for impacts to the Rough Doubletail

The retirement of these credits will be carried out in accordance with the NSW Biodiversity Offsets Policy for Major Proposals, and will be achieved by either:

- (a) retiring credits under the Biodiversity Offsets Scheme
- (b) making payments into the Biodiversity Conservation Fund
- (c) funding a biodiversity action

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APPENDIX A

ASSESSMENT AGAINST BIODIVERSITY LEGISLATION

This appendices gives consideration to supporting biodiversity legislation relevant to the study area and the proposed development. The following legislative frameworks have been addressed in this Appendix:

- Environment Protection and Biodiversity Conservation Act 1999
- Coastal Management SEPP
- The Port Stephens Comprehensive Koala Plan of Management
- Biosecurity Act 2015

A.1 ENVIRONMENT PROTECTION AND BIODIVERSITY CONSERVATION ACT 1999

An assessment of the impacts of the proposed development on Matters of National Environmental Significance, against heads of consideration outlined in Commonwealth of Australia (2013) was prepared to determine whether referral of the project to the Commonwealth Minister for the Environment is required. MNES relevant to the project are summarised in Table A.1.

Table A1: MNES relevant to the study area

MNES	Project Specifics	Potential For Significant Impact
Threatened species	One nationally listed flora species Sand Doubletail was recorded to occur within the study area. No loss of individuals of this species will be required as a result of the proposed development, it is expected that approximately 0.81 ha of suitable habitat will require removal as a result of the proposal. The loss of suitable habitat for this species has been addressed in Section 9-10 of this report and compensatory offsetting for this species under the BC Act have been defined in Section 11. Provided that the recommendations for offsetting the impact to this species and the recommendation for the protection of individuals within the study area are undertaken it is unlikely that the proposed development will result in a significant impact to this species. No other nationally significant flora or fauna species are likely to be impacted from the proposal.	Significant impact unlikely to result from the proposed development.
Threatened Ecological Communities	A review of the most relevant mapping dataset for the study area (see Section 5.1) and the locality showed that no nationally listed threatened ecological communities were present within the study area, this was verified via detailed floristic and vegetation surveys conducted within the study area to inform the body of this report.	Significant impact unlikely to result from the proposed development.
Migratory species	52 migratory bird species have been recorded or are predicted to occur in the locality. The study area does not provide nationally important habitat for any of these species.	Significant impact unlikely to result from the proposed development.
World Heritage properties	The proposed development is not considered to affect any World Heritage properties.	Significant impact unlikely to result from the proposed development.
Wetlands of international	The Myall Lakes Ramsar site is with 10km of the site. There is no hydrological connection between the study area and the Myall Lakes Wetland,	Significant impact unlikely to result from the proposed development.

MNES	Project Specifics	Potential For Significant Impact
importance (Ramsar)	hence the proposal is unlikely to a significant impact on these wetlands.	
Nuclear activities	The proposal does not involve any type of nuclear activity.	Significant impact unlikely to result from the proposed development.
Commonwealth marine environment	The proposal does not involve the modification of the Commonwealth marine environment.	Significant impact unlikely to result from the proposed development.

On this basis, no significant impacts are predicted to result from the proposed development and referral of the Project to the Australian Government Minister for the Environment will not be required.

A.2 COASTAL MANAGEMENT SEPP

A key aim of the Coastal Management SEPP (CM SEPP) is to promote an integrated and co-ordinated approach to land use planning in the coastal zone in a manner consistent with the objects of the Coastal Management Act 2016, including the management objectives for each coastal management area, by:

- managing development in the coastal zone and protecting the environmental assets of the coast, and
- establishing a framework for land use planning to guide decision-making in the coastal zone, and
- mapping the 4 coastal management areas that comprise the NSW coastal zone for the purpose of the definitions in the Coastal Management Act 2016.

The Coastal Management SEPP identifies four coastal management areas that comprise the coastal zone. These are:

- the coastal wetlands and littoral rainforests area,
- the coastal vulnerability area,
- the coastal environment area, and
- the coastal use area.

The CM SEPP imposes targeted development controls for these areas to guide appropriate development within the coastal zone.

The study area is located within a mapped area of “Coastal Environment Area”, the development controls for this area, as listed within Division 4 of the CM SEPP have been addressed below.

(1) Development consent must not be granted to development on land that is within the coastal environment area unless the consent authority has considered whether the proposed development is likely to cause an adverse impact on the following:

- *the integrity and resilience of the biophysical, hydrological (surface and groundwater) and ecological environment,*
- *coastal environmental values and natural coastal processes,*
- *the water quality of the marine estate (within the meaning of the Marine Estate Management Act 2014), in particular, the cumulative impacts of the proposed development on any of the sensitive coastal lakes identified in Schedule 1,*
- *marine vegetation, native vegetation and fauna and their habitats, undeveloped headlands and rock platforms,*
- *existing public open space and safe access to and along the foreshore, beach, headland or rock platform for members of the public, including persons with a disability,*
- *Aboriginal cultural heritage, practices and places; and*
- *the use of the surf zone.*

The potential impacts of the proposed development are primarily restricted to the removal of approximately 0.92 ha of coastal vegetation and associated biodiversity values. Methods of avoidance, minimisation and compensatory offsetting have been detailed within this report. Given the mitigation

methods detailed within this report, impacts to coastal vegetation and associated biodiversity values are expected to be of an incremental nature.

A.3 CONSIDERATIONS UNDER THE PORT STEPHENS COMPREHENSIVE KOALA PLAN OF MANAGEMENT

The Port Stephens Comprehensive Koala Plan of Management (CKPoM) has been prepared for the Port Stephens LGA in accordance with SEPP 44 – ‘Koala Habitat Protection’. The principal aim of the Port Stephens CKPoM is to encourage the proper conservation and management of areas of natural vegetation that provide habitat for Koalas to ensure a permanent free-living population over their present range and to reverse the current trend of Koala population decline.

Koala Habitat Assessments under the Port Stephens CKPoM involve four stages: preliminary assessment, vegetation mapping, Koala habitat identification and assessment of the proposal. A Koala habitat assessment has been completed below specifically for the development of this site.

A.3.1 PRELIMINARY ASSESSMENT

The preliminary assessment for the study area involves reviewing the Koala Habitat Planning Map for the area as contained in the CKPoM and undertaking a site inspection to determine whether the study area contains individuals of Koala trees outside areas marked as ‘Preferred Koala Habitat’. Review of the Koala Habitat Planning Map showed the site to contain two Koala habitat categories:

- ‘Supplementary Koala Habitat’;
- ‘Mainly Cleared’

The majority of the site has been designated as ‘Supplementary Koala Habitat’ with a small patch in the north of the site designated as ‘Mainly Cleared’ (Figure A.1).

Within the CKPoM there are three species of Eucalypt identified as Koala food trees, being *Eucalyptus robusta* (Swamp Mahogany), *Eucalyptus parramattensis* subsp. *decadens* (Drooping Red Gum) and *Eucalyptus tereticornis* (Forest Red Gum). No feed tree species were present in the study area.

A.3.2 VEGETATION MAPPING

The next step in the Koala Habitat Assessment is to provide a description of the vegetation assemblages present within the study area and to compare the results of the vegetation survey conducted for this report with the LGA wide vegetation map.

As detailed in Section 5.0, two PCTs were found to be present on the study area:

- PCT-1648 - Smooth-barked apple - blackbutt heathy open forest of the Tomaree Peninsula
- PCT-1204 - Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion

Review of the relevant LGA vegetation map (Figure 2.5 in Part 2: CKPoM Resource Document) showed vegetation on the site as being composed of two vegetation assemblages:

- 3. – Blackbutt and Smooth-barked Apple Open Forest
- 25 – Mainly cleared

Blackbutt and Smooth-barked Apple Open Forest was mapped over the majority of the study area. A small area of Mainly Cleared vegetation were present in the north-east of the site. The field investigation results were found to be consistent with the LGA vegetation map except for a small area in the south of the site composed of PCT-1204, which would be consistent with the LGA mapping as Mainly Cleared.

A.3.3 KOALA HABITAT IDENTIFICATION

Koala Habitat Identification involves:

- the application of the definitions of Preferred and Supplementary Koala Habitat detailed by Lunney *et al.* (1998) to the study area;
- the application of Habitat Buffers to all areas of Preferred Koala Habitat; and
- approximation of Habitat Linking Areas between all patches of Preferred Koala Habitat that occur within 800m of each other.

Under the definitions provided by Lunney *et al.* (1998):

- Preferred Koala Habitat is defined as a combination of the all field survey Primary, Secondary and Community Survey category A/B (regardless of whether or not they overlap);
- Supplementary Habitat – where field survey Marginal and Community Survey Category C/D overlap;
- Marginal Koala Habitat – where field survey Marginal and Community Survey Category E overlap.

Field Survey

The area of PCT-1648 was found to be most consistent with the Community Survey Category C - Tall Open Blackbutt and Sydney Red Gum Forest. The description of the map-based habitat category based on field work is most likely to be Marginal Koala Habitat – Vegetation associations containing low densities of species known to be preferred by Koalas. Where field survey Marginal and Community Survey Category C/D overlap Supplementary Habitat is obtained. The north-east and south-east portions of the site are consistent with the Community Survey category Cleared - Mainly Cleared Land (some trees). Hence Mainly Cleared is obtained for these areas.

No Koala Feed Tree Species were present nor were any areas of Preferred Koala Habitat present within the site.

A.3.4 ASSESSMENT OF THE PROPOSAL

There are eight performance criteria applied to developments proposed on sites that contain or are adjacent to 'Preferred Koala Habitat', 'Supplementary Koala Habitat', 'Habitat Buffers', 'Habitat Linking Areas' or areas that contain preferred Koala feed tree species. Each criterion is displayed in *italics* followed by the site-specific answer.

The proposed development must:

- a) *Minimise the removal or degradation of native vegetation within Preferred Koala Habitat or Habitat Buffers.*

No areas of Preferred Koala Habitat or Habitat Buffers were present within the site hence the proposal will not result in the removal or degradation of any of these areas.

- b) *Maximise retention and minimise degradation of native vegetation within Supplementary Koala Habitat and Habitat Linking Areas;*

Approximately 0.59ha of Supplementary Koala Habitat will be required to be removed for the proposed development. No Habitat Linking Areas are required to be removed. Approximately 9.64ha of Supplementary Koala Habitat will be retained within the site.

- c) *Minimise the removal of any individuals of preferred Koala food trees, wherever they occur on a study area. In the Port Stephens LGA these tree species are Eucalyptus robusta (Swamp Mahogany), Eucalyptus parramattensis (Parramatta Red Gum) and Eucalyptus tereticornis (Forest Red Gum);*

No species of recognised preferred Koala food trees were found to be present within the study area, hence the proposal will not result in the removal of any individual feed trees.

- d) *Make provisions, where appropriate, for restoration or rehabilitation of areas identified as Koala Habitat including Habitat Buffers and Habitat Linking Areas over Mainly Cleared Land;*

Approximately 4.56ha in the north of the site identified as Supplementary Koala Habitat has been subject to recent disturbance in the form of underscrubbing. Weeds should be controlled within this area to prevent further degradation and allow native species to regenerate.

- e) *Make provisions for long term management and protection of Koala habitat including both existing and restored habitat;*

Native vegetation existing north of the easement should be protected and enhanced. Areas which have been subject to recent vegetation should be allowed to regenerate to their original state.

- f) *Not compromise the potential for safe movement of Koalas across the site. This should include maximising tree retention generally and minimising the likelihood that the proposal would result in the creation of barriers to Koala movement, such as would be imposed by certain types of fencing;*

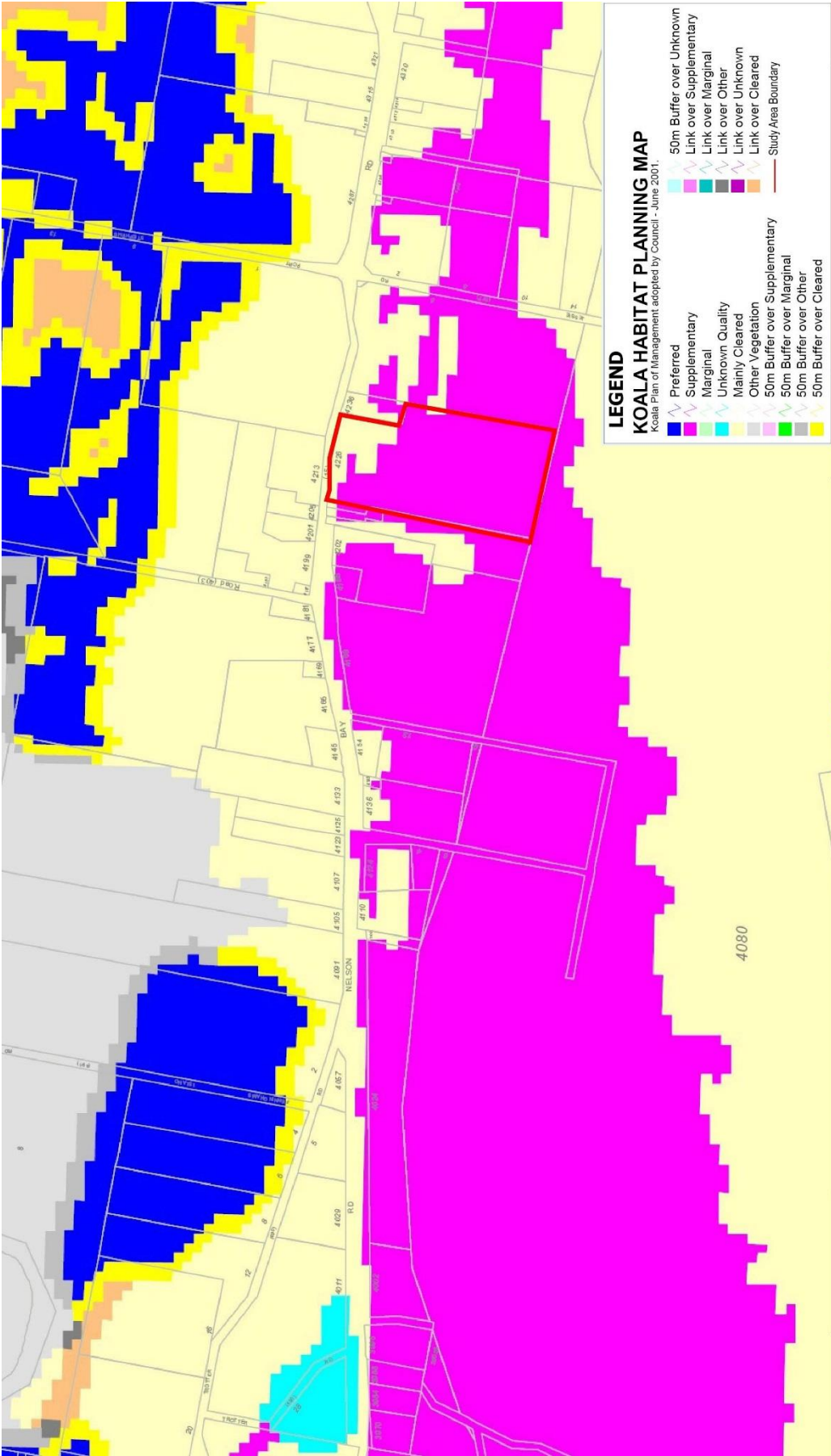
Methods of mitigation of impacts to resident fauna and to allow the safe movement of fauna across the study area have been proposed in Section 9.3.

- g) *Be restricted to identified envelopes which contain all buildings and infrastructure and fire fuel reduction zone;*

The development footprint has been defined in this report. Provisions to prevent inadvertent impact to adjacent habitat and biodiversity values have been made in Section 9.2.

- h) *Include measures to effectively minimise the threat posed by Koalas by dogs, motor vehicles and swimming pools.*

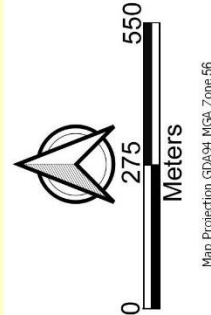
Methods of mitigation of impacts to resident fauna and to allow the safe movement of fauna across the study area have been proposed in Section 9.3.



Port Stephens
Koala Habitat
Planning Map

Lot 591 DP 1191380
Anna Bay, NSW
19 June 2018

Figure A.1



Author	DH
Reviewer	BE
Job Ref	12287
A4 Scale	

A.4 BIOSECURITY ACT 2015

The Biosecurity Act was enacted to provide for the identification, classification and control of Priority Weeds with the purpose of determining if a biosecurity risk is likely to occur, i.e.:

- The introduction, presence, spread or increase of a pest into or within the State or any part of the State.
- A pest plant has the potential to; harm or reduce biodiversity or out-compete other organisms for resources, including food, water, nutrients, habitat and sunlight.

Ten Priority Weeds for NSW North Coast which includes the Port Stephens Council LGA that have been recorded in the study area are listed in Table A.2 along with their associated Duty.

Table A.2: Priority Weed species found within the study area.

Weed Species	Biosecurity Duty	Additional Significance
<i>Senecio madagascariensis</i> (Fireweed)	• General Biosecurity Duty • Prohibition on dealings	N
<i>Nephrolepis cordifolia</i> (Fishbone Fern)	• General Biosecurity Duty • Prohibition on dealings	
<i>Arundo donax</i> (Giant Reed)	• General Biosecurity Duty • Prohibition on dealings • Regional Recommended Measure Land managers should mitigate the risk of new weeds being introduced to their land. The plant should not be bought, sold, grown, carried or released into the environment.	
<i>Eragrostis curvula</i> (African lovegrass)	• General Biosecurity Duty • Prohibition on dealings	
<i>Schinus sp</i> (Peppercorn)	• General Biosecurity Duty • Prohibition on dealings	
<i>Conyza species</i> (Fleabane)	• General Biosecurity Duty • Prohibition on dealings	
<i>Chrysanthemoides monilifera</i> subsp. <i>Rotundata</i> (Bitou bush)	• General Biosecurity Duty • Prohibition on dealings • Biosecurity Zone Within the Biosecurity Zone (all of NSW) this weed must be eradicated where practicable, or as much of the weed destroyed as practicable, and any remaining weed suppressed. The local control authority must be notified of any new infestations of this weed within the Biosecurity Zone	T N
<i>Ricinus communis</i> (Castor oil plant)	• General Biosecurity Duty • Prohibition on dealings	

Weed Species	Biosecurity Duty	Additional Significance
<i>Lantana camara</i> (Lantana)	- General Biosecurity Duty - Prohibition on dealings	T N
<i>Lilium formosanum</i> (Taiwan lily)	- General Biosecurity Duty - Prohibition on dealings	

T – Listed as a Threatening Process under the NSW BC Act 2016.

N – Weed of National Significance.

***Priorities under the Biosecurity Act 2015**

General Biosecurity Duty - any person dealing with plant matter must take measures to prevent, minimise or eliminate the biosecurity risk (as far as is reasonably practicable).

Prohibition on dealings - Must not be imported into the State or sold

APPENDIX B

EPBC Protected Matters Search Tool



EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/06/18 16:16:13

[Summary](#)

[Details](#)

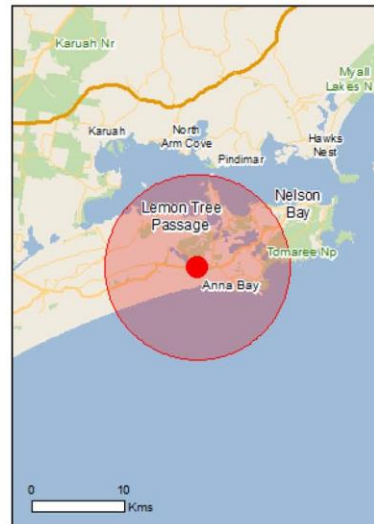
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

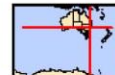
[Acknowledgements](#)



This map may contain data which are
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[Coordinates](#)

Buffer: 10.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the [Administrative Guidelines on Significance](#).

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	4
Listed Threatened Species:	70
Listed Migratory Species:	72

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at <http://www.environment.gov.au/heritage>

A [permit](#) may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	3
Commonwealth Heritage Places:	None
Listed Marine Species:	97
Whales and Other Cetaceans:	15
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	11
Regional Forest Agreements:	1
Invasive Species:	42
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar)	[Resource Information]
Name	Proximity
Myall Lakes	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
Temperate East

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community may occur within area
Lowland Rainforest of Subtropical Australia	Critically Endangered	Community may occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Foraging, feeding or related behaviour likely to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur

Name	Status	Type of Presence
<u>Charadrius mongolus</u> Lesser Sand Plover, Mongolian Plover [879]	Endangered	within area Roosting known to occur within area
<u>Dasyornis brachypterus</u> Eastern Bristlebird [533]	Endangered	Species or species habitat likely to occur within area
<u>Diomedea antipodensis</u> Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea antipodensis gibsoni</u> Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea epomophora</u> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea exulans</u> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea sanfordi</u> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<u>Erythrotriorchis radiatus</u> Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
<u>Fregetta grallaria grallaria</u> White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
<u>Grantiella picta</u> Painted Honeyeater [470]	Vulnerable	Species or species habitat may occur within area
<u>Lathamus discolor</u> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
<u>Limosa lapponica baueri</u> Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat known to occur within area
<u>Limosa lapponica menzbieri</u> Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri) [86432]	Critically Endangered	Species or species habitat may occur within area
<u>Macronectes giganteus</u> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<u>Macronectes halli</u> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<u>Numenius madagascariensis</u> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<u>Pachyptila turtur subantarctica</u> Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
<u>Phoebastria fusca</u> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area

Name	Status	Type of Presence
<u>Pterodroma leucoptera leucoptera</u> Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area
<u>Pterodroma neglecta neglecta</u> Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
<u>Rostratula australis</u> Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
<u>Thalassarche bulleri</u> Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche bulleri platei</u> Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche cauta cauta</u> Shy Albatross, Tasmanian Shy Albatross [82345]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche cauta steadi</u> White-capped Albatross [82344]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche eremita</u> Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche impavida</u> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche melanophris</u> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche salvini</u> Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
<u>Epinephelus daemeli</u> Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Frogs		
<u>Heleioporus australiacus</u> Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area
<u>Litoria aurea</u> Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area
<u>Mixophyes balbus</u> Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat likely to occur within area
Mammals		
<u>Balaenoptera borealis</u> Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Balaenoptera musculus</u> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<u>Balaenoptera physalus</u> Fin Whale [37]	Vulnerable	Foraging, feeding or

Name	Status	Type of Presence
		related behaviour likely to occur within area
<u>Chalinolobus dwyeri</u> Large-eared Pied Bat, Large Pied Bat [183]	Vulnerable	Species or species habitat known to occur within area
<u>Dasyurus maculatus maculatus (SE mainland population)</u> Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
<u>Eubalaena australis</u> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
<u>Megaptera novaeangliae</u> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<u>Petauroides volans</u> Greater Glider [254]	Vulnerable	Species or species habitat may occur within area
<u>Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)</u> Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Vulnerable	Species or species habitat known to occur within area
<u>Potorous tridactylus tridactylus</u> Long-nosed Potoroo (SE mainland) [66645]	Vulnerable	Species or species habitat likely to occur within area
<u>Pseudomys novaehollandiae</u> New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
<u>Pteropus poliocephalus</u> Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
Plants		
<u>Angophora inopina</u> Charmhaven Apple [64832]	Vulnerable	Species or species habitat known to occur within area
<u>Asperula asthenes</u> Trailing Woodruff [14004]	Vulnerable	Species or species habitat may occur within area
<u>Cryptostylis hunteriana</u> Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
<u>Cynanchum elegans</u> White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
<u>Diuris praecox</u> Newcastle Doubletail [55086]	Vulnerable	Species or species habitat likely to occur within area
<u>Eucalyptus parramattensis subsp. decadens</u> Earp's Gum, Earp's Dirty Gum [56148]	Vulnerable	Species or species habitat known to occur within area
<u>Grevillea parviflora subsp. parviflora</u> Small-flower Grevillea [64910]	Vulnerable	Species or species habitat known to occur within area
<u>Melaleuca biconvexa</u> Biconvex Paperbark [5583]	Vulnerable	Species or species habitat may occur within area
<u>Phaius australis</u> Lesser Swamp-orchid [5872]	Endangered	Species or species habitat may occur within

Name	Status	Type of Presence area
<u>Prostanthera densa</u> Villous Mintbush [12233]	Vulnerable	Species or species habitat likely to occur within area
<u>Syzygium paniculatum</u> Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
<u>Tetratheca juncea</u> Black-eyed Susan [21407]	Vulnerable	Species or species habitat likely to occur within area
Reptiles		
<u>Caretta caretta</u> Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
<u>Chelonia mydas</u> Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
<u>Dermochelys coriacea</u> Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
<u>Eretmochelys imbricata</u> Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
<u>Natator depressus</u> Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sharks		
<u>Carcharias taurus (east coast population)</u> Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Species or species habitat likely to occur within area
<u>Carcharodon carcharias</u> White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
<u>Rhincodon typus</u> Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Listed Migratory Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Migratory Marine Birds		
<u>Anous stolidus</u> Common Noddy [825]		Species or species habitat likely to occur within area
<u>Apus pacificus</u> Fork-tailed Swift [678]		Species or species habitat likely to occur within area
<u>Ardenna carneipes</u> Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
<u>Calonectris leucomelas</u> Streaked Shearwater [1077]		Species or species habitat known to occur within area
<u>Diomedea antipodensis</u> Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea epomophora</u> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or

Name	Threatened	Type of Presence
		related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Phoebastria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sternula albifrons Little Tern [82849]		Breeding likely to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche cauta Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within

Name	Threatened	Type of Presence
Hirundapus caudacutus White-throated Needletail [682]		Species or species habitat known to occur within area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area
Monarcha trivirgatus Spectacled Monarch [610]		Species or species habitat known to occur within area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [\[Resource Information \]](#)
 The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Commonwealth Land - Australian Telecommunications Commission
Commonwealth Land - Defence Housing Authority

Listed Marine Species [\[Resource Information \]](#)

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Species or species habitat known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
<u>Arenaria interpres</u> Ruddy Turnstone [872]		Roosting known to occur within area
<u>Calidris acuminata</u> Sharp-tailed Sandpiper [874]		Roosting known to occur within area
<u>Calidris canutus</u> Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
<u>Calidris ferruginea</u> Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
<u>Calidris melanotos</u> Pectoral Sandpiper [858]		Species or species habitat may occur within area
<u>Calidris ruficollis</u> Red-necked Stint [860]		Roosting known to occur within area
<u>Calidris tenuirostris</u> Great Knot [862]	Critically Endangered	Roosting known to occur within area
<u>Calonectris leucomelas</u> Streaked Shearwater [1077]		Species or species habitat known to occur within area
<u>Catharacta skua</u> Great Skua [59472]		Species or species habitat may occur within area
<u>Charadrius bicinctus</u> Double-banded Plover [895]		Roosting known to occur within area
<u>Charadrius mongolus</u> Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
<u>Charadrius ruficapillus</u> Red-capped Plover [881]		Roosting known to occur within area
<u>Cuculus saturatus</u> Oriental Cuckoo, Himalayan Cuckoo [710]		Species or species habitat may occur within area
<u>Diomedea antipodensis</u> Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea epomophora</u> Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea exulans</u> Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea gibsoni</u> Gibson's Albatross [64466]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<u>Diomedea sanfordi</u> Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<u>Fregata ariel</u> Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
<u>Fregata minor</u> Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
<u>Gallinago hardwickii</u> Latham's Snipe, Japanese Snipe [863]		Roosting may occur within area
<u>Gallinago megala</u> Swinhoe's Snipe [864]		Roosting likely to occur within area
<u>Gallinago stenura</u> Pin-tailed Snipe [841]		Roosting likely to occur within area
<u>Haliaeetus leucogaster</u> White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
<u>Heteroscelus brevipes</u> Grey-tailed Tattler [59311]		Roosting known to occur within area
<u>Himantopus himantopus</u> Black-winged Stilt [870]		Roosting known to occur within area
<u>Hirundapus caudacutus</u> White-throated Needletail [682]		Species or species habitat known to occur within area
<u>Lathamus discolor</u> Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
<u>Limosa lapponica</u> Bar-tailed Godwit [844]		Species or species habitat known to occur within area
<u>Limosa limosa</u> Black-tailed Godwit [845]		Roosting known to occur within area
<u>Macronectes giganteus</u> Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
<u>Macronectes halli</u> Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
<u>Merops ornatus</u> Rainbow Bee-eater [670]		Species or species habitat may occur within area
<u>Monarcha melanopsis</u> Black-faced Monarch [609]		Species or species habitat known to occur within area
<u>Monarcha trivirgatus</u> Spectacled Monarch [610]		Species or species habitat known to occur within area
<u>Myiagra cyanoleuca</u> Satin Flycatcher [612]		Species or species habitat known to occur within area
<u>Numenius madagascariensis</u> Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
<u>Numenius minutus</u> Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
<u>Numenius phaeopus</u> Whimbrel [849]		Roosting known to occur within area
<u>Pachyptila turtur</u> Fairy Prion [1066]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
<u>Pandion haliaetus</u> Osprey [952]		Breeding known to occur within area
<u>Phoebastria fusca</u> Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
<u>Pluvialis fulva</u> Pacific Golden Plover [25545]		Roosting known to occur within area
<u>Pluvialis squatarola</u> Grey Plover [865]		Roosting known to occur within area
<u>Puffinus carneipes</u> Flesh-footed Shearwater, Flesh-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
<u>Recurvirostra novaehollandiae</u> Red-necked Avocet [871]		Roosting known to occur within area
<u>Rhipidura rufifrons</u> Rufous Fantail [592]		Species or species habitat known to occur within area
<u>Rostratula benghalensis (sensu lato)</u> Painted Snipe [889]	Endangered*	Species or species habitat may occur within area
<u>Sterna albifrons</u> Little Tern [813]		Breeding likely to occur within area
<u>Thalassarche bulleri</u> Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche cauta</u> Tasmanian Shy Albatross [89224]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche eremita</u> Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche impavida</u> Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche melanophrys</u> Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
<u>Thalassarche salvini</u> Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Thalassarche sp. nov.</u> Pacific Albatross [66511]	Vulnerable*	Species or species habitat may occur within area
<u>Thalassarche steadi</u> White-capped Albatross [64462]	Vulnerable*	Foraging, feeding or related behaviour likely to occur within area
<u>Tringa nebularia</u> Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
<u>Tringa stagnatilis</u> Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
<u>Xenus cinereus</u> Terek Sandpiper [59300]		Roosting known to occur within area

Name	Threatened	Type of Presence
Fish		
<u>Acentronura tentaculata</u> Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
<u>Festucalex cinctus</u> Girdled Pipefish [66214]		Species or species habitat may occur within area
<u>Filicampus tigris</u> Tiger Pipefish [66217]		Species or species habitat may occur within area
<u>Heraldia nocturna</u> Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
<u>Hippichthys penicillus</u> Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
<u>Hippocampus abdominalis</u> Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
<u>Hippocampus whitei</u> White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]		Species or species habitat may occur within area
<u>Histiogamphelus briggsii</u> Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
<u>Lissocampus runa</u> Javelin Pipefish [66251]		Species or species habitat may occur within area
<u>Maroubra perserrata</u> Sawtooth Pipefish [66252]		Species or species habitat may occur within area
<u>Notiocampus ruber</u> Red Pipefish [66265]		Species or species habitat may occur within area
<u>Phyllopteryx taeniolatus</u> Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
<u>Solegnathus spinosissimus</u> Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
<u>Solenostomus cyanopterus</u> Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
<u>Solenostomus paegnius</u> Rough-snout Ghost Pipefish [68425]		Species or species habitat may occur within area
<u>Solenostomus paradoxus</u> Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
<u>Stigmatopora argus</u> Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
<u>Stigmatopora nigra</u> Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Stigmatopora olivacea a pipefish [74966]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area
Whales and other Cetaceans		[Resource Information]
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area

Name	Status	Type of Presence
<u>Balaenoptera musculus</u> Blue Whale [36]	Endangered	Species or species habitat may occur within area
<u>Balaenoptera physalus</u> Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
<u>Caperea marginata</u> Pygmy Right Whale [39]		Foraging, feeding or related behaviour may occur within area
<u>Delphinus delphis</u> Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
<u>Eubalaena australis</u> Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
<u>Grampus griseus</u> Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
<u>Megaptera novaeangliae</u> Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
<u>Orcinus orca</u> Killer Whale, Orca [46]		Species or species habitat may occur within area
<u>Sousa chinensis</u> Indo-Pacific Humpback Dolphin [50]		Species or species habitat likely to occur within area
<u>Stenella attenuata</u> Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
<u>Tursiops aduncus</u> Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
<u>Tursiops truncatus s. str.</u> Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Bushy Island	NSW
Gir-um-bit	NSW
Gir-um-bit	NSW
One Tree Island	NSW
Snapper Island	NSW
Tilligerry	NSW
Tilligerry	NSW
Tilligerry	NSW
Tomaree	NSW
Worimi	NSW
Worimi	NSW

Regional Forest Agreements [\[Resource Information \]](#)

Note that all areas with completed RFAs have been included.

Name	State
North East NSW RFA	New South Wales

Invasive Species [\[Resource Information \]](#)

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resources Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Alauda arvensis Skylark [656]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Lonchura punctulata Nutmeg Mannikin [399]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pycnonotus jocosus Red-whiskered Bulbul [631]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		Species or species habitat likely to occur within area
Frogs		
Rhinella marina Cane Toad [83218]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Lepus capensis Brown Hare [127]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Alternanthera philoxeroides Alligator Weed [11620]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Cabomba caroliniana Cabomba, Fanwort, Carolina Watershield, Fish Grass, Washington Grass, Watershield, Carolina Fanwort, Common Cabomba [5171]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera subsp. rotundata Bitou Bush [16332]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Eichhornia crassipes Water Hyacinth, Water Orchid, Nile Lily [13466]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892] Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Sagittaria platyphylla Delta Arrowhead, Arrowhead, Slender Arrowhead [68483]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Senecio madagascariensis Fireweed, Madagascar Ragwort, Madagascar Groundsel [2624]		Species or species habitat likely to occur within area
Nationally Important Wetlands		[Resource Information]
Name		State
Port Stephens Estuary		NSW

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells, by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-32.76978 152.05221

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- [Office of Environment and Heritage, New South Wales](#)
- [Department of Environment and Primary Industries, Victoria](#)
- [Department of Primary Industries, Parks, Water and Environment, Tasmania](#)
- [Department of Environment, Water and Natural Resources, South Australia](#)
- [Department of Land and Resource Management, Northern Territory](#)
- [Department of Environmental and Heritage Protection, Queensland](#)
- [Department of Parks and Wildlife, Western Australia](#)
- [Environment and Planning Directorate, ACT](#)
- [Birdlife Australia](#)
- [Australian Bird and Bat Banding Scheme](#)
- [Australian National Wildlife Collection](#)
- Natural history museums of Australia
- [Museum Victoria](#)
- [Australian Museum](#)
- [South Australian Museum](#)
- [Queensland Museum](#)
- [Online Zoological Collections of Australian Museums](#)
- [Queensland Herbarium](#)
- [National Herbarium of NSW](#)
- [Royal Botanic Gardens and National Herbarium of Victoria](#)
- [Tasmanian Herbarium](#)
- [State Herbarium of South Australia](#)
- [Northern Territory Herbarium](#)
- [Western Australian Herbarium](#)
- [Australian National Herbarium, Canberra](#)
- [University of New England](#)
- [Ocean Biogeographic Information System](#)
- [Australian Government, Department of Defence](#)
- [Forestry Corporation, NSW](#)
- [Geoscience Australia](#)
- [CSIRO](#)
- [Australian Tropical Herbarium, Cairns](#)
- [eBird Australia](#)
- [Australian Government – Australian Antarctic Data Centre](#)
- [Museum and Art Gallery of the Northern Territory](#)
- [Australian Government National Environmental Science Program](#)
- [Australian Institute of Marine Science](#)
- [Reef Life Survey Australia](#)
- [American Museum of Natural History](#)
- [Queen Victoria Museum and Art Gallery, Inveresk, Tasmania](#)
- [Tasmanian Museum and Art Gallery, Hobart, Tasmania](#)
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

APPENDIX C BAM FIELD DATA SHEETS

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

WILDTHING
Environmental Consultants

ANNA BAY

BAM Plot – Field Survey Form				Site Sheet no:	
Date		Survey Name	Plot Identifier	Recorders	
29/3/2018			BPDH1		
Zone	Datum	IBRA region	Photo #	Zone ID	
411967			5350		
Easting	Northing	Plot Dimensions	Orientation of midline from the 0 m point.		
411967	6373475		255°		
Likely Vegetation Class				Confidence:	
				H M L	
Plant Community Type				EEC:	
BRSAT - INTACT				H M L	

Record easting and northing from the plot marker. If applicable, orient picket so that perforated nb points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m ² plot)		Sum values	BAM Attribute (20 x 50 m plot)			Stem Classes and Hollows		Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately. Data needed is presence only (tick) unless a 'large tree' for that veg class. * includes all species of <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Angophora</i> , <i>Lophosiemon</i> and <i>Syncarpia</i> . † For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.
			dbh	Euc*	Non Euc	Hollows†		
Count of Native Richness	Trees	2	80 + cm			0		
	Shrubs	6	50 – 79 cm					
	Grasses etc.	5	30 – 49 cm			Hollows 20cm+		
	Forbs	3	20 – 29 cm					
	Ferns	1	10 – 19 cm			0		
	Other	0	5 – 9 cm					
Sum of Cover of native vascular plants by growth form group	Trees	0.4	< 5 cm	✓	✓	This size class records tree regeneration		
	Shrubs	2	Length of logs (m) (≥10 cm diameter, >50 cm in length)		0	total		
	Grasses etc.	4.1				0		
	Forbs	0.5						
	Ferns	5						
	Other	0						
High Threat Weed cover %		6.9						

* This table may be completed when measuring data when using the BAM. It is not intended to be used in the field.

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)				Bare ground cover (%)				Cryptogam cover (%)				Rock cover (%)						
Subplot score (% in each)	10	10	5	10	8	30	25	35	20	10	0	0	0	0	0	0	0	0	
Average of the 5 subplots	8.6					24													

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native/stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description
Back Page 5342, 43, 411917 Angled power easement Sandy soil

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400.m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders			
Date							
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	
S	1 Acacia suaveolens	N	0.2	2			
S	2 Monotoca elliptica	N	0.3	5			
S	3 Hibbertia linearis	N	1	25			
S	4 Bossiaea	N	0.2	4			
S	5 Bregia oblongifolia	N	0.1	1			
T	6 Angophora costata	N	0.1	1			
FEW	7 Pteridium esculentum	N	5	200			
* HTW	8 Andropogon virginicus		5	200			
* W	9 Anthoxanthum odoratum		8	300	300		
HTW	10 African Love grass		7	50			
G	11 Cymbopogon refractus	N	0.4	30			
G	12 Themeda australis	N	7	25			
W	13 Red Natal Grass		0.2	5			
F	14 Gonocarpus tauricoides	N	0.2	10			
G	15 Comandra longifolia	N	0.5	10			
F	16 Thicoyne elation	N	0.1	10			
HTW	17 Buffalo Grass		0.8	20			
G	18 Blady Grass	N	2	300			
W	19 Corcopsis lanceolata		0.2	5			
W	20 Primrose, OENOTHERA sp.	1	0.2	6			
W	21 Richardia		0.1	5			
W	22 Biton Bush		0.1	1			
W	23 Setaria pumila		0.1	2			
F	24 Hydrocotyle bonariensis		0.2	5			
S	25 Acacia longifolia		0.2	2			
W	26 Flacumad		0.2	10			
W	27 Canzya parviflora		0.1	5			
T	28 Banksia serrata		0.2	1			
W	29 Eragrostis sp.		0.2	10			
W	30 Plantago lanceolata		0.1	7			
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① ANNA B.

BAM Plot – Field Survey Form Site Sheet no:

Date	29/3/18	Survey Name	Plot Identifier	Recorders	
Zone	Datum	IBRA region	Photo #	5362	Zone ID
Easting	Northing	Plot Dimensions		Orientation of midline from the 0 m point.	
412049	6373525			265°	
Likely Vegetation Class					Confidence:
Plant Community Type					Confidence:
BBSAF - INACT					H M L
EEC:					H M L

Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m ² plot)	Sum values	BAM Attribute (20 x 50 m plot)	Stem Classes and Hollows		Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately Data needed is presence only (tick) unless a large tree* for that veg class * includes all species of <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Angophora</i> , <i>Lophostemon</i> and <i>Syncarpia</i> † For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem
		dbh	Euc*	Non Euc	
Trees	4	80 + cm			1
Shrubs	7	50 – 79 cm	✓		
Grasses etc.	2	30 – 49 cm	✓		Hollows 20cm+
Forbs	4	20 – 29 cm	✓	✓	
Ferns	1	10 – 19 cm	✓	✓	0
Other	5	5 – 9 cm			
		< 5 cm			This size class records tree regeneration
Sum of native vascular plants by growth form group		Length of logs (m) (≥10 cm diameter, >50 cm in length)	2.3, 1.8, 2.4, 1.0, 3.2, 1.8, 1.0, 1.4, 2.3, 2.2		total 21.5
High Threat Weed cover %	1.3				

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	70 65 65 65 70	05 0 80	00 00 00	00 00 00
Average of the 5 subplots	67	2		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35 and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

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6373598

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m² plot: Sheet _ of _

Date	Survey Name	Plot Identifier	Recorders

GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher
T	1 Angophora costata	N	15	6		
T	2 Eucalyptus p. lularis	N	15	2		
S	3 Acacia sav	N	0.2	2		
S	4 Bregnia oblongifolia	N	0.3	4		
S	5 Pittospermum undulatum	N	0.2	3		
T	6 Banksia serrata	N	12	5		
FERN	7 Adiantum esculentum	N	10	200		
S	8 Comandra longifolia	N	5	50		
F	9 Dianella caerulea var. producta	N	5	200		
O	10 Wonga Wonga Vine	N	52	5		
F	11 Gonocarpus tetragynus	N	0.4	20		
S	12 Hibbertia linearis	N	0.2	5		
S	13 Imperata cylindrica var. major	N	0.5	200		
F	14 Pomax	N	0.2	20		
HTW	W 15 Bitou Bush		0.1	13		
HTW	W 16 Lantana camara		0.2	2		
S	17 Leacopax lancaolata		0.2	5		
T	18 Glochidion forsterianum		0.2	2		
HTW	W 19 Camphor laurel		0.1	1		
O	20 Stephania japonica		0.1	2		
O	21 Parsonsia straminea		0.1	2		
S	22 Hibbertia scandens		0.2	2		
S	23 Bossi rh		0.1	1		
F	24 Pratia purpurascens		0.1	2		
O	25 Banksia mistletoe		0.1	1		
O	26 Billadaria scandens		0.1	1		
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BAM Plot – Field Survey Form				Site Sheet no:	
Date		Survey Name		Recorders	
230518		BP RE 2		BE	
Zone	Datum	IBRA region	Photo #	Zone ID	
56	GDA94		6504		
Easting	Northing	Plot Dimensions		Orientation of midline from the 0 m point.	
6412025	6373847	20 x 50		184.5°	
Likely Vegetation Class				Confidence:	
BBSAF-US				H M L	
Plant Community Type				EEC:	
				H M L	

Record easting and northing from the plot marker. If applicable, orient picket so that perforated nb points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m ² plot)		Sum values	BAM Attribute (20 x 50 m plot)		Stem Classes and Hollows		Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately Data needed is presence only (tick) unless a 'large tree' for that veg class * includes all species of <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Angophora</i> , <i>Lophostemon</i> and <i>Syncarpia</i> † For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.
			dbh	Euc*	Non Euc	Hollows†	
Count of Native Richness	Trees	3	80 + cm	1		1111	
	Shrubs	7	50 – 79 cm	111			
	Grasses etc.	3	30 – 49 cm	✓		Hollows 20cm+	
	Forbs	3	20 – 29 cm	✓			
	Ferns	1	10 – 19 cm	✓			
	Other	5	5 – 9 cm	✓			
Sum of Cover of native vascular plants by growth form group	Trees	34.1	< 5 cm	~ 40% of saplings		This size class records tree regeneration	
	Shrubs	4	Length of logs (m) (≥10 cm diameter, >50 cm in length)	0			total
	Grasses etc.	3.2					
	Forbs	4.2					
	Ferns	4					
Other	1.8						
High Threat Weed cover %		0.4					

* This table may be completed using summary data only. If a tree is present within the plot.

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	20	50	25	60	80	70	45	75	40	218										
Average of the 5 subplots	47					50.6														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Free Text Section for brief site description

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

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400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders			
Date							
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	
T	1 E. PILULARIS		75	2			
T	2 A. COSTATA		12	5			
T	3 B. SERRATA		3	1			
T	4 CLICHEDION (CHEESE TREE) (ZELEN)		1	10			
FERN	5 PTERIDIUM E		15	130			
HTW	6 Bitou Bush		0.2	10			
F	7 AGNELLUS / STELLARIA MED ROMAX UNDULATA		20	0.2			✓
G	8 PASTALIDIUM DISTANS ✓		15	0.1			
W	9 SETARIA PUMILA ✓		8	0.1			✓
O	10 GLYCINE CLAN ✓		50	0.3			✓
O	11 PANDOREA PANDOLAMA		0.1	5			
S	12 PHYLLOCLADUS / B. RHOMB B. RHOMBIFOLIA		0.5	40			✓
HTW	13 ANDROPOGON VIRGIN		0.1	2			
F	14 ACANTHUS FORNICATUS		0.2	30			
S	15 AAAYEEDUS - COMPHALOBICUM LATIFOLIUM		0.1	111			✓
S	16 HIBBERTIA SCABRA		0.1	1			✓
F	17 GONOLARUS tenoides		0.2	15			✓
G	18 COMANDRA LONG		0.5	20			
S	19 RILINDIARBUS PINISCIUS		0.1	1			✓
HTW	20 LANTANA CAMERA		0.1	1			
S	21 ACACIA SHAVE		0.2	5			
S	22 DIANELLA CERULA VAR CACTEA PANDOLAMA		0.1	10			
G	23 ENTOLASIA MARGINATA		0.1	1			
O	24 HARDEMBURGIA VIOLACEAE		0.1	3			
O	25 KENNEDIA RUBICUNDIA		0.1	1			
S	26 ACACIA BROWNII		0.1	1			✓
G	27 FLYBUSH ? LOMANDRA GRACILIS		0.1	70			✓
L	28 DIGITARIA SANGUINALIS		0.1	1			✓
F	29 PTEROSTYLUS - PHOTO 6503 WPT 558		0.1	1			
O	30 BILLIDARIA SCANDENS		0.1	3			
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BAM Plot – Field Survey Form						Site Sheet no:	
Date		Survey Name		Plot Identifier		Recorders	
23/05/18				BPBE1		BE	
Zone	Datum	IBRA region		Photo #		Zone ID	
56	SAD 60			6502			
Easting	Northing	Plot Dimensions		Orientation of midline from the 0 m point.			
0411926	6373731	20x50				2°N	
Likely Vegetation Class						Confidence:	
Plant Community Type						Confidence:	
SABFF-US						H M L	
EEC:						H M L	

Record easting and northing from the plot marker. If applicable, orient picket so that perforated nb points along direction of midline. Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

BAM Attribute (400 m ² plot)		Sum values	BAM Attribute (20 x 50 m plot)		Stem Classes and Hollows		Record living eucalypt* (Euc*) and living native non-eucalypt (Non Euc) stems separately Data needed is presence only (tick) unless a 'large tree' for that veg class * includes all species of <i>Eucalyptus</i> , <i>Corymbia</i> , <i>Angophora</i> , <i>Lophostemon</i> and <i>Syncarpia</i> † For hollows count only the presence of a stem containing hollows, not the count of hollows in that stem. Only count as 1 stem per tree where tree is multi-stemmed. The hollow-bearing stem may be a dead stem.
			dbh	Euc*	Non Euc	Hollows†	
Count of Native Richness	Trees	4	80 + cm	1		///	
	Shrubs	7	50 – 79 cm	///	1		
	Grasses etc.	5	30 – 49 cm	✓			
	Forbs	4	20 – 29 cm	✓		Hollows 20cm+	
	Ferns	1	10 – 19 cm	✓			
	Other	5	5 – 9 cm				
Sum of Cover of native vascular plants by growth form group	Trees	31	< 5 cm	✓		This size class records tree regeneration	total
	Shrubs	1.2	Length of logs (m) (≥10 cm diameter, >50 cm in length)		5.7		
	Grasses etc.	0.9					
	Forbs	0.6					
	Ferns	15					
Other	0.7						
High Threat Weed cover %	0.4						

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	50 30 70 7 60	70 20 20 90 40	0 0 0 0 0	0 0 0 0 0
Average of the 5 subplots	51.8	48		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Plot Disturbance	Severity code	Age code
Clearing (inc. logging)		
Cultivation (inc. pasture)		
Soil erosion		
Firewood / CWD removal		
Grazing (identify native stock)		
Fire damage		
Storm damage		
Weediness		
Other		

Severity: 0=no evidence, 1=light, 2=moderate, 3=severe

Age: R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Free Text Section for brief site description

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400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders			
Date							
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	
T	1 A. costata		10	3			
T	2 E. pilularis		14	3			
S	3 L. DIANELLA CERUA		3	40			
F	4 POMAX UMBELLATUM		4	8			
HTW	5 CONYZA B.		0.1	11			
FERN	6 P. esculentum		4	30	40		
S	7 LEUCOBACON LANCE		0.1	2			
O	8 TANDREA PAND		0.3	18			
O	9 HARDEMBURKIA VIOLACEAE		0.1	10			
S	10 BOSSEA THINIA - P. 6506 B. HETEROPHYLLA		0.1	1			✓
S	11 PHYLLANTHUS THINIA B. RHOMBIFOLIA		0.3	15			✓
HTW	12 SCENCIO M		0.1	11			
F	13 ALCANTHUS FORNICATUS		0.1	20			
O	14 PARSONSIA STRAMINEA		0.1	1			
	15						✓
S	16 PARSONSIA STRAMINEA COMPHALOSIUM	LAT	0.1	1			
G	17 PASPALIDILUM DISTANS		3	70			
O	18 KENNEDIA RUBICUNDA		1	25			
HTW	19 BITON BUSH		0.2	3			
S	20 ACACIA SUMME		0.3	15			
F	21 COMPHALOCARPUS teracoides		0.1	5			✓
O	22 CLYVINE CLAN		0.3	50			
G	23 ENTOLASIA MANAIA		0.1	10			
G	24 IMPERETIA CYLINDER		0.1	10			
T	25 LICHEDION FERNANDI		0.1	1			
S	26 RICINOCARPUS PINIFOLIUS		0.1	1			
W	27 HYPOCHARIS RADICATA		0.1	1			
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82					
83					
84					
85					

GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. **N:** native, **E:** exotic, **HTE:** high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

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Record easting and northing from the plot marker. If applicable, orient picket so that perforated rib points along direction of midline.
Dimensions (Shape) of 0.04 ha base plot inside 0.1 ha FA plot should be identified, magnetic bearing taken along midline.

Each size class is noted as present by the living tree stems only. Depending on the Vegetation Class, DBH values and counts may be needed for a size class. For a multi-stemmed tree, only the largest living stem is included in the count/estimate if it is required by the large tree category for that vegetation class. Hollows at least 20cm across are recorded for the purposes of habitat of some threatened species.

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots located on alternate sides and 5 m from the plot midline at the locations 5, 15, 25, 35, and 45 m along the midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Within these 1 m x 1 m plots assessors may also record the cover of rock, bare ground and cryptogam soil crusts. Collection of these data is optional - the data do not currently contribute to assessment scores, they hold potential value for future vegetation integrity assessment attributes and benchmarks, and for enhancing PCT description.

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Free Text Section for brief site description	

Age R=recent (<3yrs), NR=not recent (3-10yrs), O=old (>10yrs)

Printed 23 May 2018

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

WILDTHING

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Quote - Jalnarrda
- Book it in

400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders			
Date							
GF Code	Full species name mandatory, or a unique means of identifying separate taxa within a survey. Data from here will be used to assign growth form counts and covers.	N, E or HTE	Cover	Abund	stratum	voucher	
T	1 A. COSSATA		31	13			
T	2 F. PILULARIS		8	1			
T	3 B. SERRATA		31	13			
S	4 MONOTOCIT ELLIPTICA		10	24			
FERN	5 P. ESCULANTUM		45	500			
S	6 P. LEVIS		0.2	1			
G	7 F. CYLINDRICA		10	200			
G	8 L. LONGIFOLIA		15	110			
O	9 PANDORA PAND		3	100			
HTW	10 BITOU BUSH		8				
S	11 LEUCOPOGON LANCEOLATUM		4	25			
F	12 ACIANTHUS CORNICATUS		3	200			
O	13 PANDORA STRAEM		4.5	10			
G	14 SMALL LOMANDRA - FLUATILIS		.5	30			
S	15 PIITO UMBELLATUM		0.1	1			
F	16 PTEROSTYLIS SP		0.3	40			
S	17 D. CAERULA VAR PRODUCT		7	50			
O	18 E. RUBICUNDA		1.0	40			
S	19 ZERIA SMITH? / MHA TENGUS / ? COMPHOSIBA Lat		0.2	5			
F	20 POMAX UMBELLATA		0.5	30			
F	21 LONDRAPUS Tetradoides		0.1	10			
S	22 BOSSIA RHOMBIFOLIA / PHYLANTHUS		1	20			
O	23 NATIVE CLOVER Desmodium VARIANS		0.1	4			
O	24 Additional climber maybe still - Pandorea		1	0.1			
G	25 THEMEDIA TRIANDRA		0.1	1			
O	26 HIBBERTIA SCANDENS		2	40			
T	27 GLICHEDON FERVANDH		0.1	0.1			
S	28 LEUCOPOGON MARGAREDES	MARGAREDES	2	3			
HTW	29 LANTANA CAMEA		0.3	1			
	30 LOMANDRA FLUATILIS		0.1	10			
	31						
	32						
	33						
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	44						

6th under scribbles
Next week
Agreed on Price

Form version designed 15 September 2017

Printed 23 May 2018

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW



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GF Code: see Growth Form definitions in BAM Appendix 1. Identify top 3 dominants in the veg zone. N: native, E: exotic, HTE: high threat exotic.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Print more copies of this sheet to allow for higher species counts at a plot. All species at a plot need to be recorded.

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

BAM Site – Field Survey Form Site Sheet no:

Date	29 05 16	Plot Size	20x50	Photo #		Plot Waypoint ID	BPBE4	Recorders	DE
Midline start	6672	Midline end	6601	IBRA region					
E- 0412043		E- 412020		Vegetation Class					
N- 6372398		N- 6373444		Vegetation Zone					SPINIFEX FORE DUNE
Bearing 314 ^W		Bearing 140 ^{SE}							
PCT #		PCT Name							
Consistent BC ACT TEC?									

BAM Attribute (400 m ² plot)		Sum values
Count of Native Richness	Trees	0
	Shrubs	0
	Grasses etc.	1
	Forbs	0
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0
	Shrubs	7
	Grasses etc.	0
	Forbs	0
	Ferns	0
	Other	0
High Threat Weed cover		4

BAM Attribute (1000 m ² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm		
50 – 79 cm		
30 – 49 cm		
20 – 29 cm		
10 – 19 cm		
5 – 9 cm		
Regeneration < 5 cm		
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Large Tree Sizes

Dry Sclerophyll Forests - ≥50, Forested Wetlands - ≥50, Freshwater Wetlands - NA, Grasslands - NA, Grassy Woodlands - ≥50, Heathlands - ≥30, Rainforests - ≥50, Saline Wetlands - NA, Semi-arid Woodland (grassy sub-formation) ≥30, Semi-arid woodlands (shrubby sub-formation) ≥30, Wet sclerophyll forests (grassy sub-formation) ≥79, Wetland sclerophyll forests (shrubby sub-formation) ≥79

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	2	3	5	0	0	98	97	95	100	100										
Average of the 5 subplots	2					98														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Additional Plot Comments

WILDTHING
Environmental Consultants

400 m ² plot: Sheet _ of _		Survey Name	Plot Identifier	Recorders
Date				

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF – circle code if 'top 3'.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); **Note:** 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ..., 100, 200, ..., 1000, ...

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

BAM Site – Field Survey Form				Site Sheet no:	
Date	29 5 18	Plot Size	20x50	Plot Waypoint ID	SPBE 5
Midline start	6617	Midline end	8613	IBRA region	DE
E- 0411935	E- 411952	Vegetation Class			
N- 6373575	N- 6373530	Vegetation Zone			
Bearing 127 SE	Bearing 315 NW	Φ BBSAF - TDN INTACT			
PCT #		PCT Name			
Consistent BC ACT TEC?					

BAM Attribute (400 m² plot)	Sum values
Trees	4
Shrubs	7
Grasses etc.	6
Forbs	3
Ferns	1
Other	4
Count of Native Richness	
Trees	42-1
Shrubs	13-6
Grasses etc.	26-4
Forbs	2-3
Ferns	25
Other	3-4
Sum of Cover of native vascular plants by growth form group	
High Threat Weed cover	4-1

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	—	1
50 – 79 cm	—	
30 – 49 cm	✓	
20 – 29 cm	✓	
10 – 19 cm	✓	
5 – 9 cm	✓	14.40
Regeneration < 5 cm	✓	
Length of logs (m) (≥10 cm diameter, >50 cm in length)		

Large Tree Sizes

Dry Sclerophyll Forests - ≥50, Forested Wetlands - ≥50, Freshwater Wetlands - NA, Grasslands - NA, Grassy Woodlands - ≥50, Heathlands - ≥30, Rainforests - ≥50, Saline Wetlands - NA, Semi-arid Woodland (grassy sub-formation) ≥30, Semi-arid woodlands (shrubby sub-formation) ≥30, Wet sclerophyll forests (grassy sub-formation) ≥79, Wetland sclerophyll forests (shrubby sub-formation) ≥79

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	90 95 90 97 100	4 5 0 3 0		
Average of the 5 subplots	92.4	2.4		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Additional Plot Comments

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

400 m ² plot: Sheet _ of _		Survey Name		Plot Identifier		Recorders			
Date									
GF Code	Species	Cover	Abund	voucher	GF Code	Species	Cover	Abund	Voucher
T	<i>A. costata</i>	12	6	40%					
T	<i>S. serrata</i>	22	10						
T	<i>E. pilularis</i>	8	2						
S	<i>M. elliptica</i>	5	2						
S	<i>P. unguiculatum</i>	3	8						
O	<i>P. pandorae</i>	3	250						
S	<i>D. cerulea</i> var <i>P</i>	5	80						
G	<i>L. cylindrica</i>	20	100						
G	<i>L. filicoides</i> M	0.7	10						
HTW	<i>B. tou</i>	4	30						
F	<i>A. hirsuta</i>	2	400						
S	<i>D. rhomboides</i>	0.2	10						
S	<i>L. lanceolatum</i>	0.2	8						
O	<i>P. straminea</i>	0.1	3						
G	<i>E. marginata</i>	0.3	25						
G	<i>L. longifolia</i>	5	15						
F	<i>P. variegata</i>	0.1	15						
F	<i>P. variegata</i>	0.2	30						
O	<i>D. podium</i> PHYT	0.2	15						
S	<i>A. grave</i>	0.1	3						
HTW	<i>L. canescens</i>	0.1	1						
FERN	<i>P. escul</i>	25	110						
O	<i>G. canescens</i>	0.1	3						
G	<i>T. hirsuta</i> T	0.3	10						
G	<i>P. albidum</i> <i>subsp.</i>	0.1	4						
T	<i>S. hirsuta</i> <i>subsp.</i>	0.1	1	✓					
S	<i>P. hirsuta</i> <i>subsp.</i>	0.1	1	✓					

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF - circle code if 'top 3'.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Lot 591
DP1191380
Nelson Bay
Road
Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

BAM Site – Field Survey Form				Site Sheet no:	
Date	29/5	Plot Size	10 x 30	Photo #	
Midline start	6619	Midline end	6620	Plot Waypoint ID	BPBEC
E- 410124		E- 0412120		IBRA region	
N- 6378625		N- 6373519		Vegetation Class	
Bearing 168°		Bearing 340°		Vegetation Zone	BSSAF - DNT
PCT #		PCT Name			
Consistent BC ACT TEC?					

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	2
	Shrubs	9
	Grasses etc.	6
	Forbs	4
	Ferns	1
	Other	3
Sum of Cover of native vascular plants by growth form group	Trees	0.2
	Shrubs	6.2
	Grasses etc.	45.5
	Forbs	3.5
	Ferns	15
	Other	0.3
High Threat Weed cover		11.2

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	—	—
50 – 79 cm	—	
30 – 49 cm	—	
20 – 29 cm	—	
10 – 19 cm	—	
5 – 9 cm	—	
Regeneration < 5 cm	✓	
Length of logs (m) (≥10 cm diameter, >50 cm in length)		—

Large Tree Sizes

Dry Sclerophyll Forests - ≥50, Forested Wetlands - ≥50, Freshwater Wetlands - NA, Grasslands - NA, Grassy Woodlands - ≥50, Heathlands - ≥30, Rainforests - ≥50, Saline Wetlands - NA, Semi-arid Woodland (grassy sub-formation) ≥30, Semi-arid woodlands (shrubby sub-formation) ≥30, Wet sclerophyll forests (grassy sub-formation) ≥79, Wetland sclerophyll forests (shrubby sub-formation) ≥79

BAM Attribute (1 x 1 m plots)	Litter cover (%)					Bare ground cover (%)					Cryptogam cover (%)					Rock cover (%)				
Subplot score (% in each)	75	65	50	10	30	0	20	30	80	40										
Average of the 5 subplots	47					34														

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Additional Plot Comments

Lot 591
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Nelson Bay
Road
Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

400 m ² plot: Sheet _ of _		Survey Name		Plot Identifier		Recorders			
Date									
GF Code	Species	Cover	Abund	voucher	GF Code	Species	Cover	Abund	Voucher
G	J. CYLINDRICA	20	250						
F	COMPHLOCARPUS T	3	50						
FERN	P. esculentum	15	80						
G	T. TRIANDRA	25	300						
S	JIRUB not ^{High threat} EXIMO	5	50						
W	DESMANDIA INDICA	5	40						
S	M. elliptica	0.2	4						
S	B. ambigua	1	10						
G	ERAGROSTIS BROWNII	0.1	5						
G	Pigularia S	0.2	15						
HTW	ANDROPOGON V	7	50						
HTW	Bitou	4	25						
S	P. oblong	0.1	1						
W	ACACIA ^{PERNUM AUSTRALE}	0.1	1						
S	A. SORBUS	0.2	5						
S	LEUCOP ^{LEUCOP}	1	15						
O	D. pagon Rhytid	0.1	3						
W	Soleria P	0.5	20						
T	J. SORBUS	0.1	2						
HTW	Conyza B	0.1	10						
S	D. caerulea var P	0.4	30						
F	PERANTHERA LYM	kinda like	Black-eyed Susan						
F	Acraea LYM	0.1	25						
W	Hypochaeris R	0.2	15						
HTW	L. camera	0.1	3						
S	Aranea ulici	0.1	2						
T	Glichedion F	0.1	1						
S	Lomandra long	0.2	3						
G	ERIOCLASIA M	0.1	5						
O	PANDORA	0.1	1						
F	WITX MAIT ^{MAIT}	0.1	5						
O	HIPPOCRASSUS MAIT	0.1	1						
G	PANICUM S	0.1	1						

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF - circle code if 'top 3'.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

Lot 591
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Road
Anna Bay, NSW



Wildthing Environmental Consultants - Office # (02) 49513311

BAM Site – Field Survey Form				Site Sheet no:	
Date	25 5 19	Plot Size	20x80	Photo #	
Midline start	6622	Midline end	6624	Plot Waypoint ID	BPCE7
E- 412637		E- 0411985		Recorders	BE
N- 6373906		N- 6273895		IBRA region	
Bearing 235		Bearing 31 N/E		Vegetation Class	
				Vegetation Zone	CLEARED
PCT #		PCT Name			
Consistent BC ACT TEC?					

BAM Attribute (400 m² plot)		Sum values
Count of Native Richness	Trees	1
	Shrubs	0
	Grasses etc.	2
	Forbs	1
	Ferns	0
	Other	0
Sum of Cover of native vascular plants by growth form group	Trees	0.1
	Shrubs	0
	Grasses etc.	10
	Forbs	0.1
	Ferns	0
	Other	0
High Threat Weed cover		51

BAM Attribute (1000 m² plot)		
DBH	# Tree Stems Count	# Stems with Hollows
80 + cm	—	1
50 – 79 cm	—	
30 – 49 cm	—	
20 – 29 cm	—	
10 – 19 cm	—	
5 – 9 cm	—	
Regeneration < 5 cm		
Length of logs (m) (≥10 cm diameter, >50 cm in length)		0

Large Tree Sizes

Dry Sclerophyll Forests - ≥50, Forested Wetlands - ≥50, Freshwater Wetlands - NA, Grasslands - NA, Grassy Woodlands - ≥50, Heathlands - ≥30, Rainforests - ≥50, Saline Wetlands - NA, Semi-arid Woodland (grassy sub-formation) ≥30, Semi-arid woodlands (shrubby sub-formation) ≥30, Wet sclerophyll forests (grassy sub-formation) ≥79, Wetland sclerophyll forests (shrubby sub-formation) ≥79

BAM Attribute (1 x 1 m plots)	Litter cover (%)	Bare ground cover (%)	Cryptogam cover (%)	Rock cover (%)
Subplot score (% in each)	2 1 2 9 11	30 50 40 70 30		
Average of the 5 subplots	5	44		

Litter cover is assessed as the average percentage ground cover of litter recorded from five 1 m x 1 m plots centred at 5, 15, 25, 35, 45 m along the plot midline. Litter cover includes leaves, seeds, twigs, branchlets and branches (less than 10 cm in diameter). Assessors may also record the cover of rock, bare ground and cryptogams.

Physiography + site features that may help in determining PCT and Management Zone (optional)

Morphological Type	Landform Element	Landform Pattern	Microrelief
Lithology	Soil Surface Texture	Soil Colour	Soil Depth
Slope	Aspect	Site Drainage	Distance to nearest water and type

Additional Plot Comments

Lot 591
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Anna Bay, NSW

Wildthing Environmental Consultants - Office # (02) 49513311

400 m ² plot: Sheet _ of _		Survey Name		Plot Identifier		Recorders			
Date									
GF Code	Species	Cover	Abund	voucher	GF Code	Species	Cover	Abund	Voucher
W	FUMATORY	0.3	40						
W	PLANTAGO	0.1	10						
W	KIDNEYWEED	0.4	40						
G	CYNADON	6	70						
HTW	KIKUYU	30	4000						
W	VERBASCUM	0.1	2						
W	BIACABERRY	1	10						
W	SETARIA	6	30						
T	CHICKLEBERRY	0.1	1						
W	CYPERUS KUDRINAE	2	50						
W	SANCHUS ASIATICUS	1	5						
W	CICUTUM	0.8	5						
F	POMAR	0.1	1						
W	DIPSACIS	0.1	10						
W	FLINTWED	3	50						
W	ELUSINE IND	4	30						
W	PURSLING	0.1	5						
HTW	FOXTAIL	20	2000						
G	MICROLIGNAS	4	50						
HTW	ACROSTELLA JULGARIS	1	25						
W	GRASS	0.1							
	POREPHYLLA								

GF Code: see Growth Form definitions in Appendix 1 N: native, E: exotic, HTE: high threat exotic GF - circle code if 'top 3'.
Cover: 0.1, 0.2, 0.3, ..., 1, 2, 3, ..., 10, 15, 20, 25, ...100% (foliage cover); Note: 0.1% cover represents an area of approximately 63 x 63 cm or a circle about 71 cm across, 0.5% cover represents an area of approximately 1.4 x 1.4 m, and 1% = 2.0 x 2.0 m, 5% = 4 x 5 m, 25% = 10 x 10 m
Abundance: 1, 2, 3, ..., 10, 20, 30, ... 100, 200, ..., 1000, ...

APPENDIX D BAM CREDIT CALCULATOR OUTPUT



BAM Credit Summary Report

Proposal Details

Assessment Id	Proposal Name	BAM data last updated *
00011027/BAAS17074/19/00011032	12287_20180601_AnnaBay_BDA R	30/08/2019
Assessor Name	Report Created	BAM Data version *
Ben Ellis	03/09/2019	13
Assessor Number	BAM Case Status	Date Finalised
BAAS18078	Open	To be finalised
Assessment Revision	Assessment Type	
3	Part 4 Developments (General)	

* Disclaimer: BAM data last updated may indicate either complete or partial update of the BAM calculator database. BAM calculator database may not be completely aligned with Bionet.

Ecosystem credits for plant communities types (PCT), ecological communities & threatened species habitat

Zone	Vegetation zone name	Vegetation integrity loss / gain	Area (ha)	Constant	Species sensitivity to gain class (for BRW)	Biodiversity risk weighting	Potential SAll	Ecosystem credits
Smooth-barked Apple - Blackbutt heathy open forest of the Tomaree Peninsula								
1	1648_DNG	6.1	1.1	0.25	High Sensitivity to Potential Gain	1.75		3
3	1648_Intact	6.4	5.7	0.25	High Sensitivity to Potential Gain	1.75		16

Assessment Id	Proposal Name
00011027/BAAS17074/19/00011032	12287_20180601_AnnaBay_BDAR



BAM Credit Summary Report

					Subtotal	19
Spinifex beach strand grassland, Sydney Basin Bioregion and South East Corner Bioregion						
2 1204_Sparse	0.6	0.1	0.25	1.00		0
					Subtotal	0
					Total	19

Species credits for threatened species

Vegetation zone name	Habitat condition (HC)	Area (ha) / individual (HL)	Constant	Biodiversity risk weighting	Potential SAI	Species credits
<i>Diuris praecox</i> / Rough Doubletail (Flora)						
1648_DNG	6.1	1.12	0.25	1.5	False	3
1648_Intact	6.4	5.74	0.25	1.5	False	14
					Subtotal	17

APPENDIX E FLORA LIST

Introduced species are indicated by an asterisk (“*”).

The following standard abbreviations are used to indicate subspecific taxa:

subsp. - subspecies
var.- variety
x - hybrid between the two indicated species

Biodiversity Conservation Act (BC Act)

V Vulnerable
E1 Endangered
E2 Endangered Population
E4A Critically Endangered Population

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

V Vulnerable
E Endangered
CE Critically Endangered

FLORA LIST FOR THE STUDY AREA

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
CLASS FILICOPSIDA (Ferns)			
Davalliaceae			
* <i>Nephrolepis cordifolia</i>	Fishbone Fern		
Dennstaedtiaceae			
<i>Pteridium esculentum</i>	Bracken		
Pinaceae			
* <i>Pinus elliotii</i>	Slash Pine		
MAGNOLIOPSIDA: Magnoliidae			
LILOPSIDA: (Monocotyledons)			
Anthericaceae			
<i>Tricoryne elatior</i>	Yellow Rush-lily		
Araceae			
* <i>Colocasia esculenta</i>	Taro		
Cyperaceae			
* <i>Cyperus eragrostis</i>	Umbrella Sedge		
Liliaceae			
* <i>Lilium formosanum</i>	Formosan Lily		
Lomandraceae			
<i>Lomandra filiformis</i>	Wattle Mat- Rush		
<i>Lomandra longifolia</i>	Spiny Mat Rush		

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SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
Orchidaceae			
<i>Acianthus fornicatus</i>	Pixie Orchid		
<i>Diuris praecox</i>	Sand Doubletail	V	V
<i>Pterostylis nutans</i>	Nodding Greenhood		
Phormiaceae			
<i>Dianella caerulea</i> var. <i>producta</i>	Blue Flax-lily		
Poaceae			
* <i>Andropogon virginicus</i>	Whisky Grass		
* <i>Anthoxanthum odoratum</i>	Sweet Vernal Grass		
* <i>Arundo donax</i>	Giant Reed		
* <i>Axonopus fissifolius</i>	Narrow-leaved Carpet Grass		
* <i>Briza maxima</i>	Quaking Grass		
* <i>Chloris gayana</i>	Rhodes Grass		
<i>Cymbopogon refractus</i>	Barbed-wire Grass		
<i>Cynodon dactylon</i>	Common Couch		
<i>Digitaria parviflora</i>	Smallflower Fingergrass		
<i>Entolasia marginata</i>	Bordered Panic		
* <i>Eragrostis curvula</i>	African Love Grass		
<i>Eragrostis brownii</i>	Brown's Love Grass		
<i>Imperata cylindrica</i> var. <i>major</i>	Blady Grass		
* <i>Melinis repens</i>	Red Natal Grass		
<i>Microlaena stipoides</i> var. <i>stipoides</i>	Weeping Meadow Grass		
<i>Paspalidium distans</i>	Spreading Panic Grass		
* <i>Paspalum dilatatum</i>	Paspalum		
* <i>Setaria gracilis</i>	Slender Pigeon Grass		
* <i>Setaria parviflora</i>			
<i>Spinifex sericeus</i>	Coastal Spinifex		
<i>Themeda australis</i>	Kangaroo Grass		
Smilacaceae			
<i>Smilax australis</i>	Smilax		

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SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
<i>Smilax glyciphylla</i>	Native Sarsaparilla		
MAGNOLIIDAE (Dicotyledons)			
Anacardiaceae			
* <i>Schinus terebinthifolius</i>	Brazilian Pepper Tree		
Apiaceae			
<i>Centella cordifolia</i>			
* <i>Foeniculum vulgare</i>	Fennel		
* <i>Hydrocotyle bonariensis</i>	Kurnell Curse		
Apocynaceae			
<i>Parsonsia straminea</i> var. <i>straminea</i>	Common Silkpod/Monkey Rope		
Araliaceae			
* <i>Hedera helix</i>			
Asteraceae			
* <i>Bidens pilosa</i>	Cobblers Pegs		
* <i>Cirsium vulgare</i>	Spear Thistle		
* <i>Conyza bonariensis</i>	Flax-leaved Fleabane		
* <i>Conyza parva</i>	Whorled Fleabane		
* <i>Chrysanthemoides monilifera</i> subsp. <i>rotundata</i>	Bitou Bush		
* <i>Coreopsis lanceolata</i>	Coreopsis		
<i>Epaltes australis</i>	Spreading Nut-heads		
* <i>Hypochaeris glabra</i>	Smooth Catsear		
* <i>Hypochaeris radicata</i>	Catsear		
* <i>Senecio madagascariensis</i>	Fireweed		
* <i>Sonchus oleraceus</i>	Common Sow Thistle		
Bignoniaceae			
* <i>Jacaranda mimosifolia</i>	Jacaranda		
<i>Pandorea pandorana</i>	Wonga-wonga Vine		

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
Brassicaceae			
* <i>Cakile edentula</i>	American Sea Rocket		
Caesalpiniaceae			
<i>Senna pendula</i> var. <i>glabrata</i>			
Caryophyllaceae			
* <i>Paronychia brasiliensis</i>	Chilean Whitlow Wort		
Cassythaceae			
<i>Cassytha glabella</i>	Slender Devil's Twine		
Dilleniaceae			
<i>Hibbertia linearis</i>			
<i>Hibbertia scandens</i>	Climbing Guinea Flower		
Epacridaceae			
<i>Brachyloma daphnoides</i> subsp. <i>daphnoides</i>	Daphne Heath		
<i>Leucopogon lanceolatus</i>	Lance Beard-heath		
<i>Leucopogon margarodes</i>	Pink Bearded Heath		
<i>Monotoca elliptica</i>	Tree Broom-heath		
Euphorbiaceae			
<i>Breynia oblongifolia</i>	Coffee Bush		
<i>Glochidion ferdinandi</i> var. <i>ferdinandi</i>	Cheese Tree		
<i>Poranthera microphylla</i>			
<i>Ricinocarpus pinifolius</i>	Wedding Bush		
* <i>Ricinus communis</i>	Castor Oil Plant		
Fabaceae (Faboideae)			
<i>Aotus ericoides</i>	Heath Aotus		

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
<i>Bossiaea rhombifolia</i>			
<i>Desmodium rhytidophyllum</i>	Tick-treefoil		
<i>Desmodium varians</i>	Tick-treefoil		
<i>Dillwynia retorta</i> subsp. <i>retorta</i>	Heathy Parrot Pea		
* <i>Erythrina x sykesii</i>	Coral Tree		
<i>Glycine clandestina</i> sp. complex	Love Creeper		
<i>Hardenbergia violacea</i>	False Sarsaparilla		
<i>Kennedia rubicunda</i>	Dusky Coral Pea		
* <i>Medicago polymorpha</i>	Burr Medic		
* <i>Trifolium repens</i>	White Clover		
Fabaceae (Mimosoideae)			
<i>Acacia irrorata</i> subsp. <i>irrorata</i>			
<i>Acacia longifolia</i>	Sydney Golden Wattle		
<i>Acacia suaveolens</i>	Sweet-scented Wattle		
<i>Acacia ulicifolia</i>	Prickly Moses		
Haloragaceae			
<i>Gonocarpus teucrioides</i>	Germander Raspwort		
Lamiaceae			
<i>Clerodendrum tomentosum</i>	Hairy Clerorodendrum		
Lauraceae			
* <i>Cinnamomum camphora</i>	Camphor Laurel		
Loranthaceae			
<i>Muellerina celastroides</i>	Coastal Mistletoe		
Malvaceae			
* <i>Modiola caroliniana</i>	Red-flowered Mallow		

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
Menispermaceae			
<i>Stephania japonica</i> var. <i>japonica</i>	Snake Vine		
Myrtaceae			
<i>Angophora costata</i>	Smooth-barked Apple		
<i>Eucalyptus pilularis</i> subsp. <i>pilularis</i>	Blackbutt		
Onagraceae			
* <i>Oenothera</i> sp.	Primrose		
Oxalidaceae			
* <i>Oxalis corniculata</i>	Creeping Oxalis		
Pittosporaceae			
<i>Billardiera scandens</i>	Apple Dumplings		
<i>Pittosporum undulatum</i>	Sweet Pittosporum		
Plantaginaceae			
* <i>Plantago lanceolata</i>	Plantain		
Polygalaceae			
<i>Comesperma ericinum</i>	Matchheads		
Primulaceae			
* <i>Anagallis arvensis</i> var. <i>arvensis</i>	Scarlet Pimpernel		
Proteaceae			
<i>Banksia integrifolia</i>	Silver Banksia		
<i>Banksia serrata</i>	Old Man Banksia		
<i>Persoonia levis</i>	Broad-leaved Geebung		
Ranunculaceae			
<i>Clematis aristida</i>	Old Man's Beard		

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Anna Bay, NSW



SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT
Rubiaceae			
<i>Pomax umbellata</i>	Pomax		
* <i>Richardia humistrata</i>			
Sapindaceae			
<i>Dodonea triquetra</i>	Hop Bush		
Solanaceae			
* <i>Solanum mauritianum</i>	Wild Tobacco		
* <i>Solanum nigrum</i>	Blackberry Nightshade		
Thymelaeaceae			
<i>Pimelea linifolia</i>	Rice Flower		
Verbenaceae			
* <i>Lantana camara</i>	Lantana		
* <i>Verbena bonariensis</i>	Purple Top		
Vitaceae			
<i>Cayratia clematidea</i>	Slender Grape		

APPENDIX F FAUNA LIST

FAUNA LIST

Family sequencing and taxonomy follow for each fauna class:

Herpetofauna

Cogger (2014).

Birds

Pizzey and Knight (2012)(9th edn).

Mammals - Van Dyck & Strahan (Ed) (2008) and Churchill (2008).

Churchill, S. (2008). *Australian Bats*. (2nd edn.). Allen & Unwin Australia.

(?) - Indicates a species identified without certainty or to a Genus level only.

* - Indicates an introduced species.

The following symbols are used to indicate species recorded during previous surveys.

@ - Previous record Lot 10 DP 1071458 (Wildthing Environmental Consultants, 2008)

Threatened species addressed within this assessment appear in **bold** font.

Introduced species are indicated by an asterisk ("*").

The following standard abbreviations are used to indicate subspecific taxa:

subsp. - subspecies

var.- variety

x - hybrid between the two indicated species

Biodiversity Conservation Act 1995 (BC Act)

V Vulnerable

E1 Endangered

E2 Endangered Population

E4A Critically Endangered Population

Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

V **Vulnerable**

E **Endangered**

CE **Critically Endangered Population**

Observation Type

O - Observed (sighted)

W - Heard call

OW - Observed and heard call

X - In scat

P - Scat

T - Trapped or netted

H - Hair, feathers or skin

A - Stranded/Beached

G - Crushed cones

R - Road Kill

D - Dog Kill

Q - Camera

C - Cat Kill

V - Fox Kill

K - Dead

S - Shot

I - Fossil/subfossil

FB - Burrow

F - Tracks, scratching

Z - In raptor/owl Pellet

U - Ultrasonic recording

M - Miscellaneous

E - Nest/roost

B - Burnt

Y - Bones, teeth or shell

N - Not located

AR - Acoustic Recording

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	OBSERVATION TYPE	HABITAT TYPE
Phylum - Chordata					
Subphylum - Vertebrata					
Class Amphibia - Amphibians					
Family Myobatrachidae - 'Southern Frogs'					
<i>Crinia signifera</i>	Common Eastern Froglet			W	6
Order Squamata – Lizards and Snakes					
Suborder Sauria - Lizards					
Family Scinidae - Skinks					
<i>Lampropholis delicata</i>	Grass Skink			O	1
Class Aves - Birds					
Family Columbidae - Pigeons, Doves					
<i>Columba leucomela</i>	White-headed Pigeon			O	1
Family Accipitridae - Osprey, Hawks, Eagles and Harriers					
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle		M	O	1
Family Cacatuidae - Cockatoos and Corellas					
<i>Cacatua galerita</i>	Sulphur-crested Cockatoo			W	1
<i>Cacatua roseicapilla</i>	Galah			OW	1, 8
Family Psittacidae - Parrots, Rosellas and Lorikeets					
<i>Trichoglossus haematodus</i>	Rainbow Lorikeet			OW	1, 3, 4
Family Halcyonidae - Tree Kingfishers					
<i>Dacelo novaeguineae</i>	Laughing Kookaburra			OW	1, 3, 4
Family Maluridae					
<i>Malurus cyaneus</i>	Superb Fairy-wren			OW	1, 3, 4

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	OBSERVATION TYPE	HABITAT TYPE
Family Pardalotidae - Pardalotes, Gerygones, Scrubwrens, Heathwrens and Thornbills					
<i>Acanthiza pusilla</i>	Brown Thornbill			W	1, 3, 4
<i>Pardalotus punctatus</i>	Spotted Pardalote			W	1
Family Meliphagidae - Honeyeaters					
<i>Acanthorhynchus tenuirostris</i>	Eastern Spinebill			W	1, 3
<i>Lichenostomus chrysops</i>	Yellow-faced Honeyeater			W	1, 3, 4, 5
<i>Manorina melanocephala</i>	Noisy Miner			W	1
<i>Meliphaga lewinii</i>	Lewin's Honeyeater			W	1, 2, 3, 4, 5
Family Petroicidae - Robins and Jacky Winter					
<i>Eopsaltria australis</i>	Eastern Yellow Robin			OW	1, 3
Family Pachycephalidae - Whistlers, Shrike-tit and Shrike-thrushes					
<i>Pachycephala pectoralis</i>	Golden Whistler			W	1
Family Cinclosomatidae - Whipbird and Quail-thrushes					
<i>Psophodes olivaceus</i>	Eastern Whipbird			W	1, 3, 4, 5
Family Dicruridae - Monarchs, Flycatchers, Fantails, Drongo and Magpie-Lark					
<i>Rhipidura fuliginosa</i>	Grey Fantail			OW	1, 3, 4, 5
<i>Grallina cyanoleuca</i>	Magpie-lark			OW	1, 3, 7, 8
Family Campephagidae - Cuckoo-shrikes and Trillers					
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike			OW	1, 3, 7, 8
Family Zosteropidae - White-eyes					
<i>Zosterops lateralis</i>	Silvereye			OW	1, 3, 4
Family Artamidae - Wood-swallows, Butcherbirds, Magpie and Currawongs					

SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	OBSERVATION TYPE	HABITAT TYPE
<i>Cracticus tibicen</i>	Australian Magpie			OW	1, 2, 3, 7, 8
Family Corvidae - Crows, Raven					
<i>Corvus coronoides</i>	Australian Raven			OW	1, 2, 3, 7, 8
Family Estrildidae - Grassfinches					
<i>Neochmia temporalis</i>	Red-browed Finch			O	
Class Mammalia - Mammals					
Subclass Prototheria - Monotremes					
Order Monotremata					
Order Dasyuromorphia – Carnivorous Marsupials					
Family Dasyuridae - Dasyurids					
<i>Antechinus stuartii</i>	Brown Antechinus			T	1, 2, 3, 4
Order Peramelemorphia					
Family Peramelidae - Bandicoots					
<i>Isodon macrourus</i>	Northern Brown Bandicoot			T	1, 2, 3, 4
Order Diprotodontia					
Suborder Vombatiformes					
Superfamily - Phalangerioidea					
Family Phalangeridae - Brushtail Possums					
<i>Trichosurus vulpecula</i>	Common Brushtail Possum			O	1, 3
Superfamily - Macropodoidae					
Family Macropodidae - Kangaroos, Wallabies					
<i>Macropus rufogriseus</i>	Red-necked Wallaby			O	1
Family Vespertilionidae - Plain-nosed Bats					
<i>Chalinolobus gouldii</i>	Gould's Wattled bat			U	1

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SCIENTIFIC NAME	COMMON NAME	BC ACT	EPBC ACT	OBSERVATION TYPE	HABITAT TYPE
<i>Miniopterus australis</i>	Little Bentwing-bat	V		U, T	1
Order Rodentia					
Family Muridae - Rodents					
<i>*Rattus rattus</i>	Black Rat			T	3
Order Carnivora					
Family Canidae					
<i>*Vulpes vulpes</i>	Red Fox			O, Q, P	1
Order Lagomorpha					
Family Leporidae					
<i>*Lepus capensis</i>	European Hare			O, Q	1

Appendix E: Aboriginal Cultural Heritage Assessment



Anna Bay Sand Quarry

4226 Nelson Bay Road, Anna Bay, NSW

Aboriginal Cultural Heritage Assessment Report

Prepared for Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd
Port Stephens Local Government Area
Consultancy: Niche Environment and Heritage

20 September 2019

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Port Macquarie
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Cairns

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Cover photograph: Anna Bay Sand Quarry (Source: Niche 2018)

Executive summary

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd, to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to facilitate the development of the Anna Bay Sand Quarry at 4226 Nelson Bay Road, Anna Bay (the Project), a designated development, under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). As a designated development, the Secretary's Environmental Assessment Requirements (SEAR 1172) require that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage be undertaken.

The assessment included background archaeological and historical investigation, ongoing consultation with the Registered Aboriginal Parties and an archaeological survey that included representatives from Mur-roo-ma Incorporated, Worimi Traditional Owners Indigenous Corporation, Karuah Indigenous Corporation, Worimi Local Aboriginal Land Council, and Nur-Run-Gee Pty Ltd.

During the survey, it was determined that the southern section of the Subject Area contains an area of high sensitivity within a sand dune system, which may be a continuation of a previously recorded Aboriginal cultural heritage site within the Subject Area, AHIMS ID#38-5-032. The area of sensitivity was named Anna Bay PAD-1 (AHIMS ID#38-5-0347) and would be impacted by the proposed activity.

Subsequently, an Aboriginal Heritage Impact Permit (AHIP) was applied for in April 2019 under s.90 of the *National Parks and Wildlife Act 1974* to allow harm to Aboriginal objects by test excavation at the Anna Bay PAD-1 (AHIMS ID#38-5-0347) Aboriginal cultural heritage site. The AHIP (C0004974) was issued on 8 July 2019.

The test excavation was carried out over three days from 23 to 25 July 2019. Sixteen test pits, measuring 50 cm x 50 cm, were excavated. No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site. An Aboriginal Site Impact Recording Form (ASIRF) was submitted to BCD advising of the updated status "Not a Site".

No further investigation or impact assessment is required. Works may proceed with caution without an Aboriginal Heritage Impact Permit. Based on community consultation with the RAPs for the Project, and with the completion of this ACHA by Niche, the following recommendations have been made:

Recommendation One

- All workers should be inducted into the Subject Area so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future consent with respect to Aboriginal heritage prior and during and after construction activities.

Recommendation Two

- In the unlikely event of the identification of artefacts within the Subject Area, work in the surrounding area is to stop immediately.
- A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site.
- In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material.
- If the material is an Aboriginal object, the Proponent will notify:

- o the BCD's Enviroline on 131 555; and
 - o representatives of the RAPs.
- Facilitate, in co-operation with the appropriate authorities and the RAPs:
- The recording and assessment of the finds
- Compliance with any legal requirements and BCD directions
- The development and implementation of appropriate management strategies based on an assessment of significance of the finds.
- Recommencement of ground disturbance works may only resume once legal requirements are fulfilled

Recommendation Three

- All workers should be inducted into the Subject Area so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of consent prior and during and after construction activities
- In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately.
- The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm.
- The NSW Police must be contacted immediately.
- No further action is to be undertaken until the NSW Police provide written notification to the Proponent.
- If the skeletal remains are identified as Aboriginal, The Proponent or their agent must contact:
 - o the BCD's Enviroline on 131 555; and
 - o representatives of the RAPs.
- No works are to continue until the BCD provides written notification to the proponent or their Agent.
- An Aboriginal Heritage Impact Permit may be required to manage human remains.

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Glossary and abbreviations

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present day Aboriginal communities.
ACHA	Aboriginal Cultural Heritage Assessment
Aboriginal object(s)	The legal definition for material Aboriginal cultural heritage under the NSW <i>National Parks and Wildlife Act 1974</i> .
Aboriginal stakeholders	Members of a local Aboriginal land council, registered holders of Native Title, Aboriginal groups or other Aboriginal people who may have an interest in the Project.
AHIP	Aboriginal Heritage Impact Permit
Archaeology	The scientific study of material traces of human history, particularly the relics and cultural remains of past human activities
Archaeological deposit	A layer of soil material containing archaeological objects and/or human remains
Archaeological investigation	The process of assessing the archaeological potential of an impact area by a qualified archaeologist.
Archaeological site	An area that contains surface or sub-surface material evidence of past human activity in which material evidence (artefacts) of past activity is preserved
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	A group of artefacts found in close association with one another Any group of items designated for analysis that exist in spatial and/or vertical context – without any assumptions of chronological or spatial relatedness
Avoidance	A management strategy which protects Aboriginal cultural heritage sites within an impact area by avoiding them totally in development.
BCD	Biodiversity and Conservation Division of the Department of Planning, Industry and Environment (DPIE), previously known as the Office of Environment and Heritage (OEH)
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Code of Practice	<i>Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales</i>
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
DECCW	The Department of Conservation, Climate Change and Water, now the Office of Environment and Heritage
Development	The processes involved in preparing the Subject Area for subdivision and associated road infrastructure, including levelling and compacting for future housing constructing, and cutting and compacting areas for road infrastructure.
DA	Development Application
DPIE	Department of Planning, Industry and Environment
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
EP&A Act	<i>NSW Environmental Planning and Assessment Act 1979</i>
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Harm	With regard to Aboriginal objects this has the same meaning as the NSW <i>National Parks and Wildlife Act 1974</i> .
HMP	Heritage Management Plan
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.

Term	Definition
Impact area	An area that requires archaeological investigation and management assessment.
In situ	Latin words meaning 'on the spot, undisturbed'.
Isolated artefact / find	A single artefact found in an isolated context.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Land unit	An area of common landform, and frequently with common geology, soils and vegetation types, occurring repeatedly at similar points in the landscape over a defined region. It is a constituent part of a land system.
Landform	Any one of the various features that make up the surface of the earth.
LEP	Local Environmental Plan
Management plans	Conservation plans which identify short and long term management strategies for all known Aboriginal cultural heritage site s recorded within a (usually approved) Subject Area.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and Aboriginal cultural heritage site conservation.
NPW Act	National Parks and Wildlife Act 1974
NPW Regulation	National Parks and Wildlife Regulation 2009
OEH	Office of Environment and Heritage
Open camp site	An archaeological Aboriginal cultural heritage site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill, etc.).
PAD	Potential Archaeological Deposit. A location considered to have a potential for subsurface archaeological material.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Aboriginal cultural heritage site	A place where past human activity is identifiable.
Spit	A unit of archaeological excavation with an arbitrary assigned measurement of depth and extent.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.
PSC	Port Stephens Council

1. Introduction

Hay Enterprises NSW Pty Ltd (the Proponent) intends to establish the Anna Bay Sand Quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period (the Project). The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380) (the Subject Area) within the coastal, semi-rural locality of Anna Bay. It is situated 12 km southwest of Nelson Bay and 25 km northeast of Newcastle Airport in the Port Stephens region of NSW, in the Parish of Tomaree, in the County of Gloucester, in the Port Stephens Council Local Government Area (LGA) (Figure 1, Figure 2).

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd to produce an Aboriginal Cultural Heritage Assessment Report (ACHAR) in accordance with the following guidelines:

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (Department of Environment, Climate Change and Water, 2010)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (Department of Environment, Climate Change and Water, 2010) (Hereafter referred to as the Code of Practice)
- *Guide to Investigating assessing and reporting Aboriginal Cultural heritage in NSW* (Office of Environment and Heritage, 2011)
- *Applying for an Aboriginal Heritage Impact Permit: Guide for applicants* (Office of Environment and Heritage, 2011)

1.1 The proponent and Subject Area

The Proponent intends to establish the Anna Bay Sand Quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period (the Project). The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 in Deposited Plan 1191380) within the coastal, semi-rural locality of Anna Bay, 12 km south west of Nelson Bay and 25 km north east of Newcastle Airport. The Subject Area is situated within the Port Stephens region of NSW, in the Parish of Tomaree, in the County of Gloucester, and in the Port Stephens Council Local Government Area (Figure 1, Figure 2).

1.2 The proposed development

The main components of the development proposal are depicted in Figure 3 and will be:

- The extraction of sand dune to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.

This work will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

Following the removal of vegetation along the northern face of the dunes within the Subject Area, the aeolian sand is now able to encroach upon the transmission line easement. The emergency extraction of

sand from beneath the transmission lines is evidence of the danger this can pose. The quarrying of sand from the Subject Area will assist with keeping the dunes out of the transmission easement

1.3 Statutory context

The proposed Anna Bay Sand Quarry will be assessed as a Designated Development as per Schedule 3 subclauses 19(1) (c) (iii) and 19(1) (c) (VI) of the *NSW Environmental Planning and Assessment Act, 1979* (EP&A Act) and is being considered by Port Stephens Council under Part 4 of the EP&A Act. Secretary's Environmental Assessment Requirements (SEARs) (SEAR #1172) were issued on 23 October 2017 for the project and required that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological) should be conducted. This included evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage. This cultural heritage assessment was undertaken to inform an Environmental Impact Statement (EIS).

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty on behalf of Hay Enterprises NSW Pty Ltd to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform the EIS for the Project. Niche has prepared the ACHA in accordance with the following legislation, regulation and guidelines:

- *National Parks and Wildlife Act 1974* ('NPW Act')
- *National Parks and Wildlife Regulation 2009* ('NPW Regulation')
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* (Department of Environment, Climate Change and Water NSW, 2010) ('Consultation Requirements')
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage 2011)
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change and Water NSW, 2010)
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH)
- *The Burra Charter* (The Australia ICOMOS charter for places of cultural significance)

1.4 Objectives

The assessment requirements and objectives for the Aboriginal Cultural Heritage Assessment are provided in the Table below.

Table 1: Assessment requirements and objectives

Objectives:	Addressed in:
• Identify whether Aboriginal objects could be present within the Subject Area	Appendix A
• Undertake further investigation within areas identified as having potential high sensitivity	Appendix A
• Provide a description of the Aboriginal objects and declared Aboriginal places located within the area of the proposed activity	Section 2
• Provide a description of the cultural heritage values, including the significance of the Aboriginal objects and declared Aboriginal places, that exist across the whole area that will be affected by the proposed activity and the significance of these values for the Aboriginal people who have a cultural association with the land	Section 5, Section 6

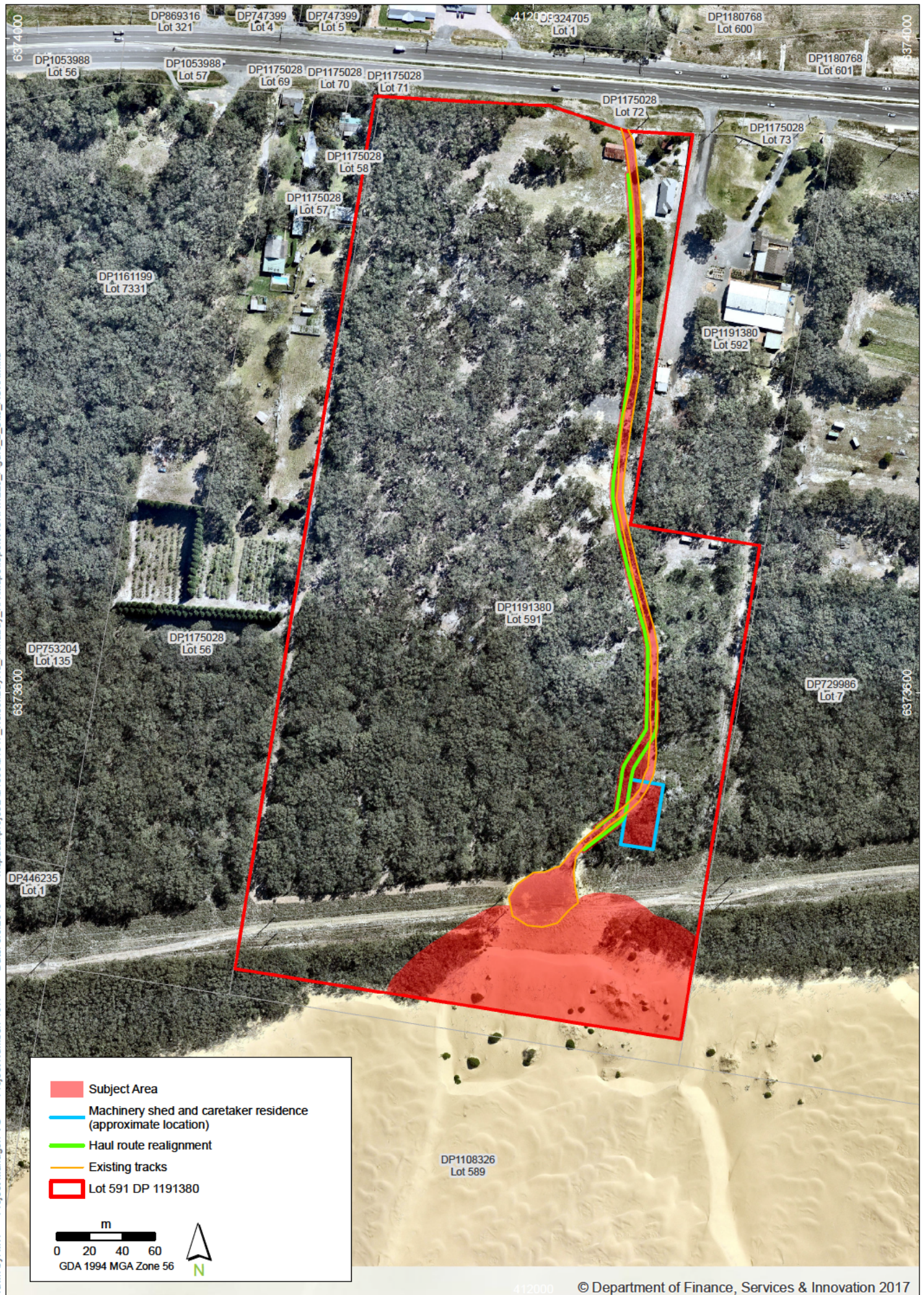
Objectives:	Addressed in:
• Demonstrate how the requirements for consultation with Aboriginal people have been met (as specified in clause 80C of the NPW Regulation)	Section 3, Appendix C
• Present the views of those Aboriginal people regarding the likely impact of the proposed activity on their cultural heritage (if any submissions have been received as a part of the consultation requirements, the report must include a copy of each submission and response)	Section 3, Appendix C
• Provide an assessment actual or likely harm posed to the Aboriginal objects or declared Aboriginal places from the proposed activity, with reference to the cultural heritage values identified	Section 6
• Provide any practical measures that may be taken to protect and conserve those Aboriginal objects or declared Aboriginal places and any practical measures that may be taken to avoid or mitigate any actual or likely harm, alternatives to harm or, if this is not possible, to manage (minimise) harm.	Section 7, Section 8

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 Drawn by: MH Project Manager: BH Project Number: 4226 Date: 8/6/2019



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location of Subject Area within regional context (Source: Tattersall Lander Pty Ltd, LPI and Niche)
 4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Figure 1: Location of Subject Area within regional context (Source: Tattersall Lander Pty Ltd, LPI and Niche)

4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

2. Description of the Area

2.1 Project Location

The Proponent intends to establish the Anna Bay Sand Quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380) within the coastal, semi-rural locality of Anna Bay, 12 km south west of Nelson Bay and 25 km north east of Newcastle Airport. It is situated within the Port Stephens region of NSW, in the Parish of Tomaree, in the County of Gloucester, and in the Port Stephens Council Local Government Area (Figure 1, Figure 2).

2.2 Description of Aboriginal objects within the Subject Area

2.2.1 Aboriginal Objects

An extensive Aboriginal Heritage Information Management System (AHIMS) search was conducted on 18 January 2018 (AHIMS Client ID: 322781) centred on the Subject Area (Figure 4, Attachment 2). Background research and a cultural heritage and archaeological survey were also completed over the Subject Area, the results of which are presented in more detail in Section 3.4.3.

One previously recorded Aboriginal cultural heritage site was identified within the Subject Area, known as NBRd 4 (AHIMS ID# 3850320). This Aboriginal cultural heritage site comprises shell fragments on the ground surface, with the high possibility of the presence of more shell in the area as part of an extensive shell midden. The registered site card for this Aboriginal cultural heritage site is attached at Appendix C.

Thirteen (13) additional Aboriginal cultural heritage sites were located outside the Subject Area within a 1 km distance, including surface stone artefact scatters, shell middens with stone artefacts, and potential archaeological deposits (PADs) (Figure 3). The AHIMS sites are summarised in Table 2.

Table 2: Previously recorded AHIMS sites within 1 km of the Subject Area

AHIMS No.	Site Features
38-5-0121	Artefacts and shell
38-5-0198	Artefact
38-5-0223	Artefact and shell
38-5-0250	Artefacts and shell
38-5-0320	Shell
38-5-0321	Shell
38-5-0319	Shell
38-5-0312	Artefact
38-5-0310	Artefact and shell
38-5-0311	Potential Archaeological Deposit (PAD)
38-5-0327	Artefact
38-5-0324	Potential Archaeological Deposit (PAD)
38-5-0325	Potential Archaeological Deposit (PAD)
38-5-0331	Artefact

The frequencies of Aboriginal cultural heritage site types within the search area are consistent with regional trends identified during previous studies within close proximity to the current assessment (for example (McCardle Cultural Heritage, 2016; McCardle Cultural Heritage Pty Limited, 2015). Aboriginal cultural heritage sites are variable distances from permanent water sources throughout the AHIMS search area, with the majority located approximately 1 km from the ocean and approximately 2.5 km from Tilligerry Creek.

2.2.2 Aboriginal cultural heritage sites within the Subject Area

The previously recorded Aboriginal cultural heritage site, NBRd 4 (AHIMS ID#38-5-0320), was relocated in the northern part of the property during the site inspection. The Aboriginal cultural heritage site will not be impacted by the proposed haul road, as the section in close vicinity to the NBRd 4 (AHIMS ID#38-5-0320) has been already built and there are no significant modifications proposed for this road.

During the site survey, one area of archaeological potential was identified within the Subject Area — Anna Bay PAD 1 (AHIMS ID#38-5-0347) (Table 3). This was defined as the immediate vicinity and foreground of the sand dunes in the southern section of the property (Figure 3). An archaeological test excavation was completed over the Aboriginal cultural heritage site (see Appendix A). No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site and an Aboriginal Site Impact Recording Form (ASIRF) was submitted to BCD advising of the updated status “Not a Site”.

Table 3: Details of the previously and newly recorded Aboriginal cultural heritage sites within the Subject Area

Site name and number	Site Features	Status	Easting	Northing
NBRd 4 (AHIMS ID #3850320)	Shell, Potential Archaeological Deposit	Valid	412046	6373942
Anna Bay PAD 1 (AHIMS ID 38-5-0347)	Potential Archaeological Deposit	Not a site	412042	6373398

2.2.3 Other heritage registers

Searches of numerous heritage databases, as well as the Port Stephens Local Environmental Plan 2013 (LEP) and Port Stephens Development Control Plan (DCP), were undertaken by Niche on 31 January 2018.

No listed heritage items are located within the Subject Area (Table 4); however, a number of heritage items are located nearby (Figure 4). Further consideration of historic heritage items is provided in a separate Heritage Impact Assessment (Niche Environment and Heritage, 2018a).

Table 4: Heritage registers search results

Heritage Registers	Heritage Items in the Subject Area	Nearby Heritage Items
World Heritage List	None	None
National Heritage List	None	None
Commonwealth Heritage List	None	None
State Heritage Register	None	Birubi Point Aboriginal Place
State Heritage Inventory	None	Birubi Point Cemetery (Item ID:12)
Local Environmental Plans	None	Stockton Beach Dune System (Item ID: 134)

Heritage Registers	Heritage Items in the Subject Area	Nearby Heritage Items
Development Control Plans	None	DCP Controls apply to the above heritage items.

2.2.3.1 Birubi Aboriginal Place

Birubi Point, which is located 1.4 km the east of the Subject Area, is a registered Aboriginal Place due to its continued association with the Worimi people. It was registered as an Aboriginal Place 5062849 (file number 07/18962 & DOC 07/50249 & DOC1) under the NPW Act in 2007. It is a traditional Aboriginal ceremonial and burial site, which contains extensive archaeological material considered important to the teaching of the current and future generations about the local Aboriginal culture. This site is connected with the Worimi Conservation Lands, which are a joint management of a number of National Parks and Conservation Areas. This place provides valuable information regarding the archaeological potential of the Subject Area due to its proximity and context.

2.2.3.2 Birubi Point Cemetery

Birubi Point Cemetery is located approximately 2.3 km from the Subject Area. Birubi Point Cemetery was in use between 1876 and 1996 and contains the graves of early settlers to the area, as well as shipwrecked persons, some of who were unidentified. The cemetery is located adjacent to the original lot of land settled by the Blanch family in the 1950s (Plate 1). The point on which the cemetery is located was known as Cemetery Point, until the name was officially changed in 1976; it is now located within the lands of the Birubi Point Aboriginal Place. The first internment in 1876 was that of Lucy Blanch who was an Anna Bay pioneer. The cemetery contains a layout plan on a plaque and includes a list of all the known burials within the cemetery, numbering 88 internments.

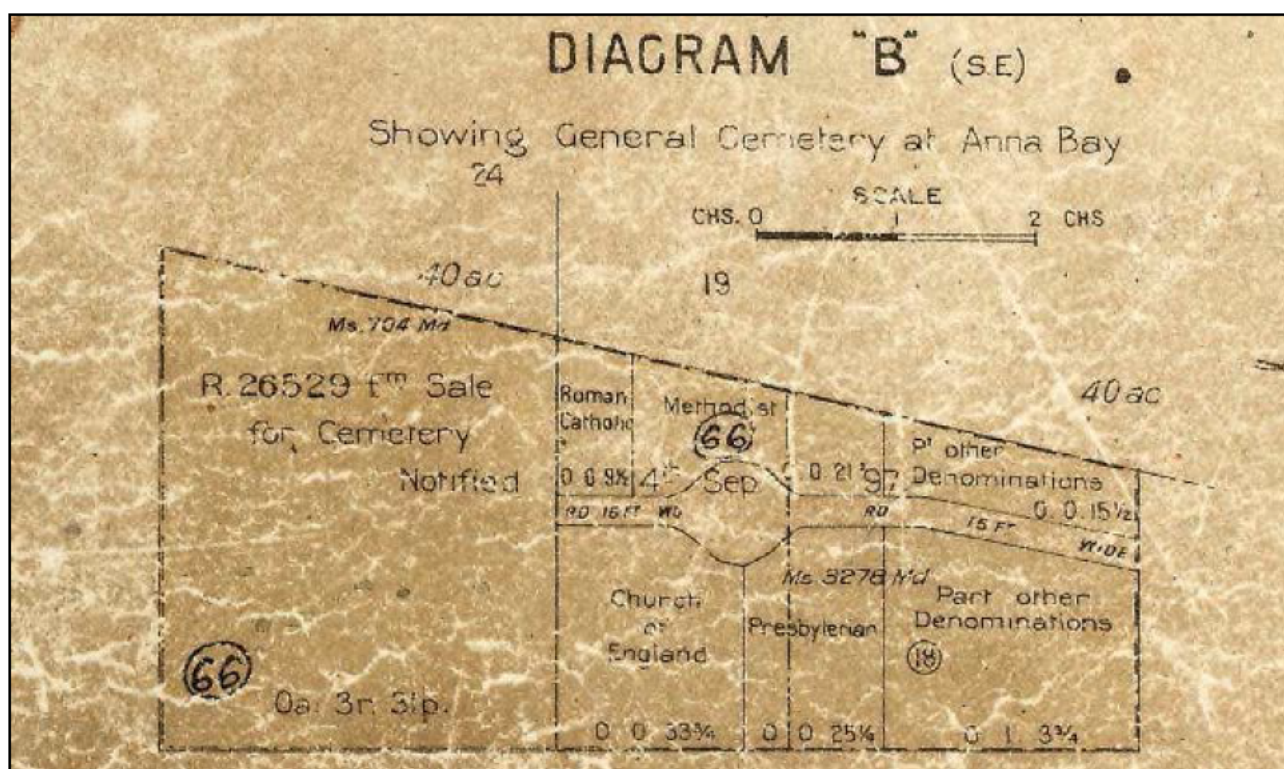


Plate 1: Insert from the 1967 Tomaree Parish map showing the layout of the Birubi Cemetery.

2.2.3.3 Stockton Beach Dune System

Stockton Beach dune system is the largest moving coastal land mass in the southern hemisphere, and stretches from Stockton to Anna Bay covering a distance of approximately 25 kilometres in length. The dunes are moving inland at a rate of about one metre per year, following their destabilisation in the nineteenth century by severe storms and cattle grazing. According to the Register of the National Estate, the entire bight (stretching from the Hunter River Estuary to Birubi Point in the north) is of significance for its unique natural ecosystem (RNE Place ID: 19510).

As a result of the shifting sand sheet, Aboriginal midden sites, burials and education sites important to the Worimi peoples, as well as World War II fortifications, are periodically covered and revealed by the moving sands. These sand dunes are directly adjacent to the Subject Area, and are encroaching northwards from the southern boundary of the Subject Area. Their dynamic nature means that archaeological material may exist within the Subject Area subsurface. The defence lines that were constructed on Stockton Beach during World War II were part of the Northern Defence Line, which was a part of the nationwide response to the Japanese attacks on Darwin and submarines entering Sydney and Newcastle harbours (OEH 2015:27). The defensive tank traps were set up along the entire line of the beach, and infantry-manned heavy and light artillery stations were established at the southern end of the beach at Fern Bay. Tank traps which were removed from their emplacements now form the boundaries of an overflow car park just below Birubi Point at the northern end of the beach. The northern end of the beach, located south of Birubi Point was used as a bombing and military training location during World War II (OEH 2015:27). The weapons range, which was established during the war with an area approximately totalling 400 hectares, including an area directly to the south of the Subject Area. The area continued to be used as a RAAF weapons range until at about 1965 (Plate 2). Unexploded ordinance is still recovered from the sand dunes and are subject to protocols from the NSW Police and Department of Defence (OEH 2015:27).

Located within the central section of the beach, behind the fore dune, are a group of eleven corrugated iron structures with gable or skillion roofs. They have been named “Tin City” by the locals. The original huts date to the 1940s and 50s and were constructed for use by recreational fishermen in the area. The majority of the huts that are currently standing were constructed in the 1970s and 1980s, with the most recent hut constructed in 1992. None of the original huts from the 1940s and 1950s are still standing, but those that remain continue to be used by fishermen (OEH 2015:28). The remains of destroyed huts on the southern and central areas of the beach remain under the shifting sand dune, subject to exposure by local sand drift.

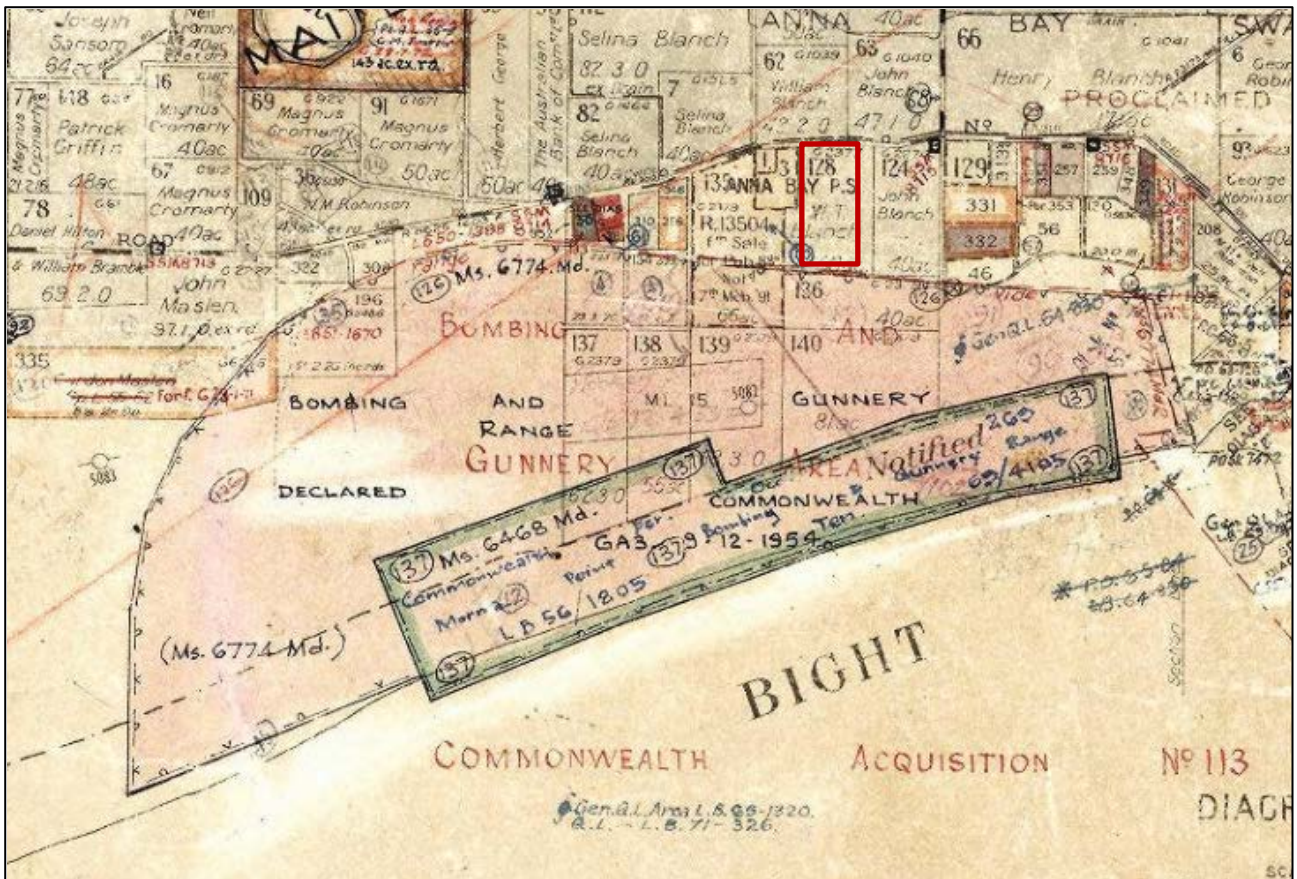


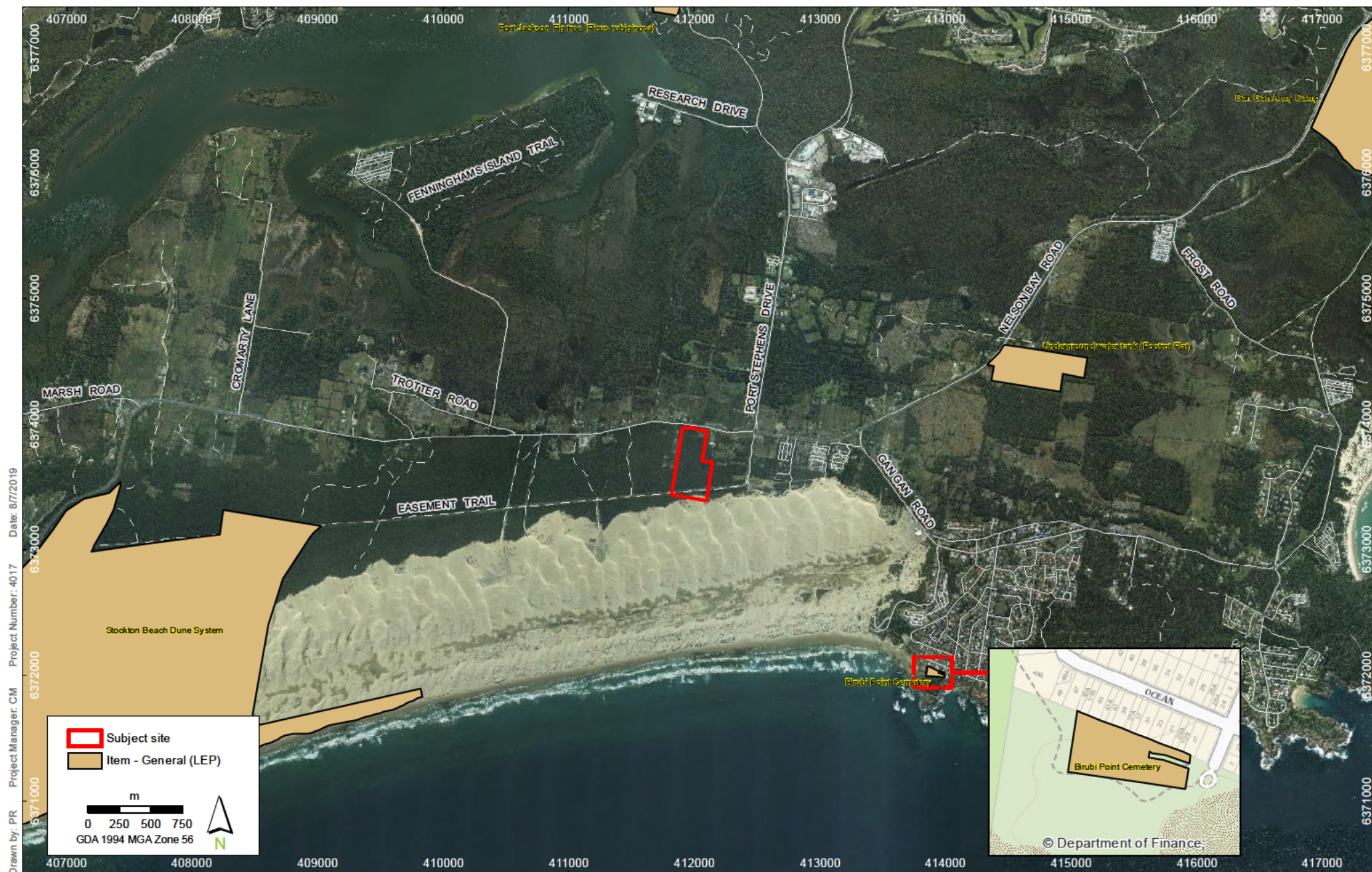
Plate 2: 1967 Tomaree parish map outlining "bombing and gunnery range" abutting onto the Subject Area (indicative location shown in red). (Source: LPI)



Aboriginal cultural heritage sites within proximity of the Subject Area
(Source: Tattersall Lander Pty Ltd, OEH and Niche)
4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

FIGURE 3

Imagery: (c) Nearmap 2018-09-09



2.3 Environmental Context

2.3.1 Topography, geology and soils

The Subject Area is situated within a coastal region zone, situated in the outer Holocene dunes and located east of the Newcastle Bight sand barrier system with an extremely low local relief of less than 9 m (Matthei, 1995). The conventional coastal formation model establishes that the inner Pleistocene barrier was deposited during the last Inter Glacial period of high sea level (c. 120,000 years before present [BP]) and was later modified by erosion. After several sea level fluctuations the sea level rose (c. 18,000 BP) to form parallel sets of beach ridges in what is now the outer Holocene barrier (McCardle Cultural Heritage Pty Limited, 2015; Robson et al., 1993).

The Subject Area is located on Quaternary gravel, sand, silt, clay, and Waterloo rock, fresh and marine deposits (Newcastle Geological Sheet, 1966), lying in the outer Holocene barrier and sand dunes. These dunes are stable and have the potential to contain stratified deposits dating back to 4,500 BP (Dean-Jones, 1990).

Archaeological deposits may remain intact in subsurface areas as evidenced by a salvage excavation undertaken within 120 m of the Subject Area (McCardle Cultural Heritage Pty Limited, 2015).

The Shoal Bay soil landscape in the northern section of the Subject Area is characterised by gently inclined, well-drained Pleistocene sand sheets to rolling very low dunes. Slope gradients generally <5%, but on slopes of rolling dunes up to 15%. Local relief generally <5 m and elevation <15 m. Dunes are usually well drained. Soils are deep (>300 cm), well-drained Podzols (OEH 2019)

The Hawks Nest soli landscape in the southern section of the Subject Area is characterised by stable, gently undulating, Holocene sand sheets and beach ridges. Local relief <3 m, slope gradients <10%, elevation 3–12 m. Generally well drained apart from isolated low lying poorly drained swales. Vegetation typically comprises uncleared and extensively cleared dry shrubland, woodland and tall open-forest. Soils are deep (>300 cm), well-drained Podzols on dunes with deep (>300 cm) minor Acid Peats/ Siliceous Sands in swampy swales (OEH 2019).

2.3.2 Hydrology

There are no permanent fresh water sources within the Subject Area (see Figure 5). Based on climatic analysis, the investigation area will typically experience comparatively reliable rainfalls under normal conditions. The nearest permanent fresh water sources are available in the surrounding locality at Bobs Farm Creek (and swamp) (2.4 km to the northwest) and Fenninghams Island Creek (2.1 km to the northwest); however, ephemeral drainage lines, which were dry at the time of survey, were observed within the Subject Area. The southern boundary of the Subject Area is 1200 m north of the current coastline.

2.3.3 Ecology

A range of faunal populations including kangaroo, wallaby, goanna, snakes and a variety of birds is present in the Subject Area, with a wider variety of resources available in the nearby swamplands and on the beach front. The wide variety of available resources would have allowed for sustained occupation of the area. The most suitable area for Aboriginal occupation would have been the northern end of the Subject Area. This is due to its nearness to the inter barrier depression (within 60 m) that would have provided easy access to both fresh water, flora, fauna and estuary and marine resources.

2.3.4 Past land use and disturbance

The historic land use in the Subject Area is summarised here.

The degree of past land use and disturbance within the Subject Area is minimal. The Subject Area is located within a land grant belonging to a W. T. Blanch, who is likely John and Lucy Blanch's son William, born in 1863. The Blanch family owned much of the land within the Anna Bay area in the earliest days of European settlement, from at least the 1850s (Anna Bay Public School, 2014). It is unknown from documentary evidence what activities took place within the Subject Area, but it has remained predominately uncleared native vegetation until recent times.

Historical aerial imagery from 1963 (see Figure 6) shows two garage buildings and a gabled roof building present fronting the road on 4226 Nelson Bay Road. At this time, directly to the west of the building group, within the Subject Area, was a cleared and cultivated field. There were long, potentially farm-related, structures running east-west across the property, extending approximately to the house and barns fronting the road. An unformed, cleared track through the native vegetation, likely relating to the transmission line, ran near the southern boundary of the Subject Area at this time; it was most likely developed following the cessation of the RAAF activities to the south of the Subject Area.

Aerial imagery shows that by 1985, the east-west farm building located to the south of the main domestic building within the Subject Area has been demolished and the majority of the cleared farm paddock to the west of the domestic building has regrown vegetation. It should also be noted that in this imagery, the sand has encroached towards the transmission line from the south, where it was not visible before. The transmission line has also been cleared and a gravel road surface added.

In imagery from 2015, Nelson Bay Road has been widened and straightened. The original residential structure and swimming pool, which once existed in this roadside area, has been demolished during the resumption process. The remaining three garage buildings are now fronting the road. The current access track exists in the 2015 imagery.

During the site inspection, it was established that the Subject Area has been cleared at its northern extent. Current disturbances include ancillary structures, an access road, and clearing for a transmission line easement. The extent of clearing and disturbance reduces the likelihood for intact Aboriginal cultural heritage sites or objects to be preserved in this area.

2.4 Past Aboriginal land use

Past Aboriginal land use of the Subject Area can be re-traced using previously recorded archaeological resources, historical observations of early settlers and surveyors, and contemporary comments from Aboriginal people (though the inherent bias present in historical European observations must be recognised). While a detailed review of previously recorded archaeological resources in the area will be provided in the Archaeological Report, after test excavation are completed, it is succinctly summarised here.

The reconstruction of past land use by Aboriginal people in the Port Stephens area and the structure of their society is an extremely difficult task and, apart from the archaeological record, relies on documents written by non-Aboriginal people, including early surveyors, military officers and settlers. The inherent bias of the viewpoint, class and culture, and lack of exposure or understanding to Aboriginal culture of those people inevitably affected their observation and conclusions about the Aboriginal way of life. Historical accounts also make comment on a culture already disrupted by the European settlement and the effects of colonisation. The gaps in oral and written histories for the area in the early years of European occupation

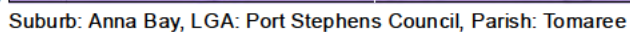
lead to a patchwork—at best—account of life before European arrival. It is also important to note that the behaviours and site activities that are recorded during the early years of European settlement do not typify the Aboriginal way of life going back millennia. One way to look at Aboriginal life with a longer view is to examine archaeological evidence, but this view does not give an indication of the changes in belief systems, social organisation or language that can occur over the long swathes of time that are encompassed by the archaeological record.

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas. The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The land and waters have been used for thousands of years for hunting and gathering foods, fishing and the continuation of cultural, spiritual and sacred activities. Aboriginal cultural connections have always been strong in this area and continue today, as it is still a well-utilised fishing and recreational area used by today's Worimi people (McCardle Cultural Heritage Pty Limited, 2015).

Approximately 4.8% (3,325 people) of the population within the Port Stephens LGA identify as Aboriginal and/or Torres Strait Islander according to census data (Australian Bureau of Statistics).

Past Aboriginal land use is demonstrated in the Subject Area through the presence of the shell midden NBRd 4 (AHIMS ID# 3850320). Activities that are likely to have occurred within the Subject Area include:

- Hunting and gathering of foods (shellfish and other marine resources).
- Intermittent camping and occupation.



4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

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Drawn by: GT Project Manager: VG Date: 8/7/2019 Project Number: 4017



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

niche
Environment and Heritage

Historical aerial photography (Source: Tattersall Lander Pty Ltd, LPI and Niche)
4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

FIGURE 6

Imagery: (c) LPI 1966-2009, NearMap 2010-2018

3. The Consultation Process

In administering its statutory functions under Part 6 of the NPW Act, OEH requires that proponents consult with Aboriginal people about the Aboriginal cultural heritage values (cultural significance) of Aboriginal objects and/or places within any given development area, in accordance with Clause 80c of *NSW National Parks and Wildlife Regulation 2009* ('the Regulation').

The OEH maintains that the objective of consultation with Aboriginal communities about the cultural heritage values of Aboriginal objects and places is to ensure that Aboriginal people have the opportunity to improve ACHA outcomes (DECCW 2010a). This is ensured by:

- providing relevant information about the cultural significance and values of Aboriginal objects and /or places,
- informing the design of the methodology to assess cultural and significance of Aboriginal objects and/or places,
- actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal objects and/or places within the proposed Subject Area, and
- commenting on draft assessment reports before they are submitted by the Proponent to the OEH.

Consultation in the form outlined in the Consultation Requirements (DECCW 2010a) is a formal requirement in cases where a proponent is aware that their development activity has the potential to harm Aboriginal objects or places. The OEH also recommends that these requirements be used when the certainty of harm is not yet established but a proponent has, through some formal development mechanism, been required to undertake a cultural heritage assessment to establish the potential harm their proposal may have on Aboriginal objects and/or places.

The Consultation Requirements outline a four-stage consultation process that includes detailed step-by-step guidance as to the aim of the stage, how it should be proceed, and what actions are necessary for it to be considered successfully completed. The four stages are:

- Stage 1 – Notification of project proposal and registration of interest.
- Stage 2 – Presentation of information about the proposed project.
- Stage 3 – Gathering information about the cultural significance of the project area.
- Stage 4 – Review of the draft Aboriginal Cultural Heritage Assessment report.

The Consultation Requirements also outline the roles and responsibilities of the OEH, Registered Aboriginal Parties (RAPs) including Local and State Aboriginal Land Councils, and proponents throughout the consultation process.

To meet the requirements of consultation it is expected that the Proponent will:

- Bring the RAPs (or their nominated representatives) together and be responsible for ensuring appropriate administration and management of the consultation process.
- Consider the cultural perspectives, views, knowledge and advice of the RAPs involved in the consultation process when they assess cultural significance and work together to develop any heritage management outcomes for Aboriginal object(s) and/or place(s).
- Provide evidence to the OEH of consultation by including information such as cultural perspectives, views, knowledge and advice provided by the RAPs.
- Accurately record and clearly articulate all consultation findings in the final cultural heritage assessment report.

- Provide copies of their final cultural heritage assessment report to the RAPs who have been consulted.

The consultation process undertaken to seek active involvement from appropriate Aboriginal representatives for the project followed the current NSW statutory guidelines – the Consultation Requirements. Section 1.3 of the Consultation Requirements describes the guiding principles of the document, which have been derived directly from the Principles section of the Australian Heritage Commission’s *Ask First: A guide to respecting Indigenous heritage places and values* (Australian Heritage Commission, 2002). Both documents share the aim of creating a system where advice can be sought from the Aboriginal community.

The following sections outline the process and results of the consultation conducted during this assessment to ascertain and reflect the Aboriginal cultural heritage values of the Subject Area. Further detail in regards to the Aboriginal community consultation process is outlined in Appendix B.

3.1 Preliminary investigations

A due diligence assessment was completed over the Subject Area. The due diligence assessment included a field assessment completed by Viki Gordon (Heritage Consultant), Jamie Merrick (Sites Officer Worimi Local Aboriginal Land Council), Lennie Anderson (Nu-Run-Gee Pty. Ltd.) and Rebecca Young (Mur-Roo-Ma Incorporated) on 23rd January 2018. The field assessment was undertaken to determine whether the project design would impact any Aboriginal objects. The due diligence assessment recommended further investigation.

3.2 Stage 1 – Notification of project proposal and registration of interest

3.2.1 Notification of Agencies

Notification was initiated on 24 April 2018 to all relevant organisations named under Section 4.1.2 of the Consultation Requirements. This is done to identify Aboriginal people who may have cultural knowledge relevant to the subject Area and who may have an interest in the proposed project. The list of the contacted organisations is provided in Table 5 and a copy of the notification letter is provided in Appendix B.

Table 5: List of contacted organisations

Name of Organisation	Date of notification sent	Date of response received
Port Stephens Council	24 April 2018	2 May 2018
Local Land Services	24 April 2018	No response received
NSW Office of Environment and Heritage, Hunter Valley	24 April 2018	9 May 2018
National Native Title Tribunal	24 April 2018	26 April 2018
NTS Corp Limited	24 April 2018	26 April 2018
Office of the Registrar, Aboriginal Land Rights Act 1983	24 April 2018	1 May 2018
Worimi Local Aboriginal Land Council	24 April 2018	1 May 2018

3.2.2 Advertisement

In accordance with Section 4.1.3 of the guidelines, a newspaper advertisement was placed in the Bay, Myall Coast, Medowie and Tilligerry, and Raymond Terrace News of the Area on 26 April 2018 with a close date for responses from interested RAPs of 5 pm on the 9 May 2018 (14 days). This was done to provide additional

opportunity for Aboriginal people who may be interested in the project to come forward. A copy of the advertisement is included in Appendix B.

3.2.3 Notification of potential stakeholders

A list of potential cultural knowledge holders was compiled from submissions and information collected during the notification and registration periods. A copy of the contact letter is included in Appendix B. The following organisations and/or individuals were contacted:

- AGA Services
- Birubi Point Cultural Heritage Advisory Panel
- Cacatua Cultural Consultants
- Carol Ridgeway-Bissett
- Crimson Rosie
- Didge Ngunawal Clan
- Divine Diggers Aboriginal Cultural Consultants
- Gomeroi Namoi
- Hunters and Collectors
- Karuah Indigenous Corporation
- Kawul Pty Ltd trading as Wonn1 Sites
- Lakkari NCTG
- Lower Hunter Aboriginal Corporation
- Murra Bidgee Mullangari Aboriginal Corporation
- Mur-Roo-Ma Incorporated
- Nur-Run-Gee Pty Ltd
- Roger Matthews Consultancy
- Traditional Owner
- Wattaka Wonnarua CC Service
- Widescope Indigenous Group
- Wiradjuri Condobolin Corporation Ltd
- Wonnarua Elders Council
- Worimi Conservation Lands Board of Management
- Worimi Local Aboriginal Land Council
- Worimi Traditional Owners Indigenous Corporation

3.2.4 Registered Aboriginal Parties

As a result of the Stage 1 enquiries, the following organisations and/or individuals became RAPs for this project (see Table 6), and a consultation log of all correspondence is included in Appendix B.

Table 6: Registered Aboriginal Parties

Organisation	Contact Name
Didge Ngunawal Clan	Paul Boyd and Lilly Carroll
Divine Diggers Aboriginal Cultural Consultants	Deidre Perkins
Gomeroi Namoi	Steve Talbott
Karuah Indigenous Corporation	David Feeney
Murra Bidgee Mullangari Aboriginal Corporation	Ryan Johnson, Darleen Johnson-Carroll
Mur-Roo-Ma Incorporated	Bec Young
Nur-Run-Gee Pty Ltd	Leonard Anderson
Widescope Indigenous Group	Steven Hickey
Worimi Local Aboriginal Land Council	Andrew Smith
Worimi Traditional Owners Indigenous Corporation	Candy Lee Towers
-	Jamie Merrick

3.2.5 Section 4.1.6 Notification to OEH and LALC

Notification of RAPS to the OEH and Worimi Local Aboriginal Land Council, as per Section 4.1.6 of the Consultation Requirements, was sent on 13 August 2018.

3.3 Stage 2 - Presentation of information about the proposed project

The RAPs were provided with a letter outlining information about the project, and an assessment methodology for the site inspection, in accordance with the Consultation Requirements and the Code of Practice. The project information was provided on 20 August 2018 (see also Section 3.4), with the statutory time frame for commenting on the methodology closing at 5 pm, 18 September 2018.

3.4 Stage 3 – Gathering information about the cultural significance of the Subject Area

3.4.1 Assessment Methodology – Site Inspection

As detailed in Section 3.3, the RAPs were provided with an assessment methodology for the initial site inspection in accordance with the Consultation Requirements and the Code of Practice.

The purpose of the provided documents was to:

- Describe the project, outline the project scope, time frame and proposed works.
- Describe the environment of the Subject Area and information relevant to the ACHA process.
- Provide an opportunity for the RAPs to understand the process and comment on the proposed methodology.
- Set a time frame for providing feedback and comments on the methodology and project information.

The draft methodology for the field survey was submitted to the RAPs on 20 August 2018; the closing date for comments was at 18 September 2018 (28 days). Copies of the cover letter and methodology are included in Appendix B.

A number of RAPs provided feedback on the project information and assessment methodology. Their comments and/or review are outlined in Table 7, and copies of all submissions made are included in Appendix B.

3.4.2 Assessment Methodology – Archaeological Test Excavations

As a result of the site inspection and preliminary investigation, the need for an archaeological test excavation was identified. An archaeological test excavation methodology was developed.

The purpose of the provided documents was to:

- Describe the project, outline the project scope, time frame and proposed works.
- Describe the environment of the Subject Area and information relevant to the ACHA process.
- Provide an opportunity for the RAPs to understand the process and comment on the proposed methodology.
- Set a time frame for providing feedback and comments on the methodology and project information.

The draft methodology for the test excavation was submitted to the RAPs on 08 March 2019; the closing date for comments was at 08 April 2019 (28 days). Copies of the cover letter and methodology are included in Appendix B.

A number of RAPs provided feedback on the project information and assessment methodology. Their comments and/or review are outlined in Table 7, and copies of all submissions made are included in Appendix B.

Table 7: Details of RAPs and feedback from Stages 2 and 3

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
Site Inspection Phase			
Murra Bidgee Mullangari	Ryan Johnson	I have read the project information ACHA and methodology for the above project and endorse the recommendations made by Niche. My family and members have a long history in the Anna Bay area, my grandfather resided in Anna Bay for over 10 years.	None required
Mur-Roo-Ma Inc.	Anthony Anderson	Murrooma have read and fully understand the ACHA/Methodology for the proposed Sand Quarry at Anna Bay. Murrooma has completed a due diligence of this proposed project area with Niche – Vicki Gordon previously, we discussed some recommendations whilst onsite. This included a Cultural Heritage Management Plan that is put in place in line with all other Sand Quarries within the Worimi area. Anthony Anderson and Bec Young are representatives of Murrooma who both hold specific cultural knowledge and education relevant to determining the significance of Aboriginal objects and places in the Port Stephens/Anna Bay region. We are both Traditional Custodians of the Worimi area and are in a position to speak for country. The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to our ancestors and storylines. We have previously been involved in the extensive salvage (Salvage AHIP excavation at 108 Nelson Bay Road, Bobs Farm to Anna Bay- McCardle Heritage) directly across the road from this proposed development and we believe that the midden material outlined in the AHIMS search (AHIMS ID#38-5-032) may be a continuation of this previous salvaged site.	The information provided by Mr Anthony Anderson has been incorporated into the summary of background information and the significance assessments for the Subject Area. The recommendation for an ACHMP has been discussed further in Section 7

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
		We agree with the methodology for the archaeological and cultural heritage survey assessment and Murrooma will be able to discuss cultural values and collection of information further onsite. We believe that in order to gain the specific information that will be required for this area, it must be sorted through Local Knowledge Holders and this is what we can offer in the consultation or engagement process.	
Community Services Section Manager-Port Stevens Council on behalf of Birubi Point Cultural Heritage Advisory Panel	Steve Bernasconi	The information will be passed on to the advisory panel.	None required
Didge Ngunawal Clan	Lilly Carroll	DNC agrees to the proposed methodology @ Nelson Bay Rd, Anna Bay. Keep us posted for any further updates	None required
Nur-Run-Gee Pty Ltd	Leonard James Anderson	Wasn't sure if our offices had passed on the information you required? We have read the Methodology agree with its recommendations etc., but would like to discuss some finer points onsite, as persons not engaged on the proposal can and will read any statements and utilize for their own intelligence gathering outside of the Project!	Opportunity for discussions occurred during site survey
Widescope	Steven Hickey	Thank you, I have reviewed and support the Methodology Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3.	None required
Karuah Indigenous Corporation	Dave Feeney	The Project Methodology for 4226 Nelson Bay Road, Anna Bay Aboriginal Cultural Heritage Assessment is all good what I have read.	None required
Worimi Local Aboriginal Land Council	James Merrick	Worimi agrees with the methodology and would like to register our interest in the project please see the attachments	None required
Worimi Traditional Owners Indigenous Corporation	Candy Towers	The subject areas 4226 Nelson Bay Road, Anna Bay NSW, is culturally significant to the Worimi Tribe as this area is located not too far from the shore line. I could identify that the Worimi people would have used	This comment has been incorporated into the Summary and analysis of background information in

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
		this area for generations. I have not inspected the area personally but the area does tell me that there is a lot of potential for Aboriginal objects to be present. Also members of Worimi TOIC claim the area to be significant to Worimi people.	Section 4 and the significance assessment in Section 5.

3.4.3 Archaeological Survey

A list of participants is provided in Table 8.

Table 8: Fieldwork attendance: Archaeological survey

Registered Aboriginal Party	Representative	Attendance
Nur-Run-Gee Pty Ltd	Lennie Anderson	11 October 2018
Karuah Indigenous Corporation	Dave Feeney	11 October 2018
Worimi Local Aboriginal Land Council	Jamie Merrick	11 October 2018
Worimi Traditional Owners Indigenous Corporation	Candy Towers	11 October 2018
	Tom Towers	11 October 2018
Mur-Roo-Ma Incorporated	Bec Young	11 October 2018

3.4.4 Archaeological Test Excavation

A list of participants is provided in Table 9.

Table 9: Fieldwork attendance: Archaeological test excavation

Registered Aboriginal Party	Representative	Attendance
Nur-Run-Gee Pty Ltd	Chris Collinson	23–25 July 2019
Karuah Indigenous Corporation	Dave Feeney	23–25 July 2019
Worimi Local Aboriginal Land Council	Brendan Lilley	23–25 July 2019
Worimi Traditional Owners Indigenous Corporation	Luke Knight	23–25 July 2019
Mur-Roo-Ma Incorporated	David Kirk	23–25 July 2019

3.5 Stage 4 – Review of draft cultural heritage assessment reports

A draft of the ACHA report that accompanied the AHIP application for testing was provided to the RAPs for their review and comment on 8 March 2019 in accordance with the Consultation Requirements (DECCW, 2010a). A statutory timeframe of a minimum of 28 days for responses was provided to all RAPs, with a request for comments to be provided by 5 pm 8 April 2019.

The responses in Table 10 detail the comments made by the RAPs, as well as Niche's response, and copies of all submissions made are included in Appendix B.

Following notification of the AHIP on 8 July 2019, a final copy of the ACHA and AHIP was sent to all RAPs in accordance with Section 4.4.5 of the Consultation Requirements (DECCW 2010a).

Following the test excavation, a draft of this ACHA report was provided to the RAPs for their review and comment on 20 August 2019 in accordance with the Consultation Requirements (DECCW, 2010a). A statutory timeframe of a minimum of 28 days for responses was provided to all RAPs, with a request for comments to be provided by 5 pm 17 September 2019.

The responses in Table 11 detail the comments made by the RAPs, as well as Niche's response, and copies of all submissions made are included in Appendix B.

Table 10: Feedback provided during Stage 4 (ACHAR and AHIP)

Registered Aboriginal Party	Stakeholder	Comment made	Response from Niche
Widescope Indigenous Group	Steven Hickey	I have reviewed and support the Anna Bay ACHA and test excavation methodology. Regards Steven Hickey	Thank you for your feedback.
Didge Ngunawal Clan	Paul Boyd	DNC agrees with the methodology for Anna Bay test excavation.	Thank you for your feedback.
Murra Bidgee Mullangari	Ryan Johnson	Hi Morgan, I have read the ACHA and test excavation methodology for the above project, I endorse the recommendations made by Niche, please feel free to contact me if you require further details.	Thank you for your feedback.
Mur-Roo-Ma Inc.	Bec Young	Murrooma Incorporated has read and fully understands the draft Aboriginal Cultural Heritage and Archaeological Assessment from Niche, commissioned by Tattersall Lander for proposed project at Anna Bay. We agree with all aspects of this report and have viewed the draft methodology strategies and proposed test excavation methodology as outlined. Murrooma has previously discussed the importance of this area and significance to our people. We appreciate the use of Murrooma's idea to have a potential cultural heritage management plan in line with all other sand quarries locally and understand this will be discussed further into the assessment framework. Murrooma agrees with the test excavation methodology and agrees with the difficulty of testing the unstable land form/dune system but agree it definitely needs to be tested/sampled, due to the movement of the sand dunes and constantly changing conditions. E.g. there may be a visual site there one day and then with movement of the dune you can return to same area and not be able to see any sites. The recommendations and methodologies within this draft report meet our requirements as Traditional knowledge holders of this area and maintain the protection and best options for our local Aboriginal cultural heritage sites. Please contact if you have any questions, Thank you Bec Young- Murrooma -Operations Manager/Sites Officer Anthony Anderson - Murrooma- CEO.	Thank you for your feedback.
Divine Diggers Aboriginal Cultural Heritage Consultants	Deidre Perkins	Good morning Morgan, No comment it all seems good and I know if any issues came up on site it would be look after. Sincerely Deidre	Thank you for your feedback.

Table 11: Feedback provided during Stage 4 (ACHAR and AR)

Registered Aboriginal Party	Comment made	Response from Niche
Divine Diggers Aboriginal Cultural Consultants	Hello Wade, I have read over the draft and it seems fine to me. Thank you Deidre	Thank you for your feedback.
Karuah Indigenous Corporation	Hi Wade; Firstly; thanks for the Draft report, I have read the report and understand all parts of the report also the including the archaeological survey report in which I found to be OK. I also agree to all recommendation of the report and happy to continue with any works around the Anna Bay Sand Quarry project Lot 4017_4226 Nelson Bay Road, Anna Bay NSW, and give and information as required around Cultural & Heritage with this project. Thank you	Thank you for your feedback.
Mur-Roo-Ma Inc	Murrooma Incorporated has read and fully understands the draft Aboriginal Cultural Heritage and Archaeological Assessment report for Anna Bay Sand Quarry. As per our phone discussion, no sand will be quarried from any part of the remnant dune and only drift sand will be utilised for proposed works- for the entirety of the sand mining contract . We agree with all aspects of this report including the results of the test excavation, proposed mitigation and recommendations and this meets our requirements as Traditional Knowledge Holders of the Worimi area and maintains the protection and best options for our local Aboriginal sites. Please contact if you have any questions, Thankyou	Thank you for your feedback

4. Summary and Analysis of Background Information

The Subject Area is located in the Coastal Zone of the Hunter Valley, in particular, it is situated within the outer Holocene barrier and sand dunes. The resources in this area would have been well utilised by Aboriginal people in the past, but modifications including residential developments are likely to have disturbed areas containing archaeological materials. The Outer Holocene Barrier contains stable dunes and the potential to contain stratified deposits dating back to 4,500PB (Dean-Jones, 1990).

The Stockton Bight is a unique coastal embayment and a well preserved example of a dual barrier system close to the major metropolitan centres of Newcastle and Sydney (Australian Heritage Database). The Newcastle Bight has some of the largest midden sites in NSW as well as burial and educational sites (Australian Heritage Database). The barrier dune system of the Stockton Bight is 31 km long and ranges from one to two kilometres in width.

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas (McCardle Cultural Heritage Pty Limited, 2015). The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The Stockton Beach Dune System is the largest mobile dune in coastal Australia and represents an important area of cultural heritage (OEH, 2004).

The area was rich in resources, with direct access to marine (both ocean and estuarine), forest and stone resources from the neighbouring headlands. The history of the Worimi people and the connection with the area is abundantly evident in the extent and diversity of the cultural material present throughout the adjoining areas. For example, spears used for fishing were made from the flowering stem of the Grass Tree or Gynea Lily, with prongs of ironbark used on the tips.

Port Stephens was not entered by Europeans until late 1871 when the 'Salamander', docked, transporting convicts to Sydney. It appears that the earliest Europeans to live in the area were five escaped convicts, wrecked at Port Stephens in 1790 (McCardle Cultural Heritage Pty Limited, 2015). The Worimi were extremely accommodating, taking them into their tribe (McCardle Cultural Heritage Pty Limited, 2015). Five years later they were 'rescued' by Captain W.R. Broughton with the Reliance and Supply.

The frequencies of Aboriginal cultural heritage site types within the search area are consistent with regional trends identified during previous studies within close proximity to the current assessment. Aboriginal cultural heritage sites are variable distances from permanent water sources throughout the immediately surrounding region, with the majority (of those located in proximity to the Subject Area) located approximately 1 km from the ocean and approximately 2.5km from Tilligerry Creek (Figure 3).

The AHIMS search identified one Aboriginal cultural heritage site within the Subject Area, known as NBRd 4 (AHIMS ID# 38-50320). The Aboriginal cultural heritage site comprises shell fragments on the ground surface, with the high possibility of the presence of more shell in the area as part of an extensive shell-midden. Thirteen (13) additional Aboriginal cultural heritage sites were located outside the Subject Area within a 1 km distance, including surface stone artefact scatters, shell middens with stone artefacts, and potential archaeological deposits (PADs).

The Worimi people maintain a strong relationship with their traditional lands. Despite the social and cultural dislocation that would have occurred post-European settlement of the area, many Aboriginal

people continue to live within the Port Stephens region and its surrounds, and continue to care for country and make decisions on the management and maintenance of Aboriginal cultural heritage sites and matters.

“The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to our ancestors and storylines”. (Anthony Anderson, Mur-Roo-Ma Incorporated).

5. Cultural Heritage Values and Statement of Significance

5.1 Methods of assessing heritage significance

Heritage significance is assessed by considering each Aboriginal cultural heritage site against the significance criteria set out in the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011).

Niche recognises that Aboriginal people are the determinants of the cultural significance of their heritage. If any culturally sensitive values of the Subject area were identified, their specifics would not be included in this report, or made publicly available, but would be documented and lodged with the knowledge holder providing the information.

5.2 Assessment framework

The Burra Charter (Australian ICOMOS, 1999) defines the basic principles and procedures to be observed in the conservation of important places. It provides the primary framework, within which decisions about the management of heritage sites in Australia should be made. The Burra Charter defines the cultural significance as being derived from the values listed below (Section 5.3.1 to 5.3.4).

5.3 Identifying values

The information collected during the background review of the project can be used to help identify social, historical, scientific and aesthetic values. The review of background information and knowledge gained through consultation with Aboriginal people should provide insight into past events. These include how the landscape was used and why the identified Aboriginal objects are in this location, along with contemporary uses of the land.

Information gaps are not uncommon and should be acknowledged. They may require further investigation to adequately identify the values present across the subject area. It may be helpful to prepare a preliminary value map that identifies, to the extent of information available, information such as:

- Known places of social, spiritual and/or cultural value including natural resources of significance.
- Known historic places.
- Known Aboriginal objects and/or declared Aboriginal places.
- Potential places/areas of social, spiritual and/or cultural value including natural resources, of places of historic or archaeological significance.

Places of potential value that are not fully identified or defined should be included as 'sensitive' areas to target further investigation.

5.3.1 Social or cultural value

Social or cultural value refers to the spiritual, traditional, historical or contemporary associations and attachments the place or area has for Aboriginal people. Social or cultural value is how people express their connection with a place and the meaning that place has for them.

Places of social or cultural value have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities and individuals can experience a sense of loss should a place of social or cultural value be damaged or destroyed.

There is not always consensus about a place's social or cultural value. When identifying values, it is not necessary to agree with or acknowledge the validity of each other's values, but it is necessary to document the range of values being identified.

Social or cultural value can only be identified through consultation with Aboriginal people. This could involve a range of methodologies such as cultural mapping, oral histories, archival documentation and/or specific information provided by Aboriginal people specifically for the investigation.

When recording oral history:

- Identify who was interviewed and why.
- Document the time, place and date the interview was conducted.
- Describe the interview arrangements (the number of people present, recording arrangements, information access arrangements).
- Summarise the information provided by each person interviewed.
- Provide a summary of the information provided to the person being interviewed.

More information on conducting oral history projects can be found in the OEH publication *Talking history: oral history guidelines* (Veale, 2004)

Occasionally information about social value may not be forthcoming. In these circumstances, documentation of the consultation process is required, making it clear in discussions and conclusions about social value, that this was the case.

5.3.2 Historic value

Historic value refers to the associations of a place with a historically important person, event, time period or activity in an Aboriginal community. Historic places do not always have evidence of their historical importance (such as structures, planted vegetation or landscape modifications). They may have 'shared' their historic values with other (non-Aboriginal) communities.

Places of post-contact Aboriginal history have generally been poorly recognised in investigations of Aboriginal heritage. Consequently, the Aboriginal involvement and contribution to important regional historic themes is often missing from accepted historical narratives. This means it is often necessary to collect oral histories along with archival or documentary research to gain a sufficient understanding of the historic values.

5.3.3 Scientific (archaeological) value

This refers to the importance of a landscape, area, place or object because of its rarity, representativeness and the extent to which it may contribute to further understanding and information (Australia ICOMOS, 1988).

Information about scientific values is gathered through any archaeological investigation undertaken. Archaeological investigations must be carried out according to OEH's Code of Practice (DECCW, 2010b).

5.3.4 Aesthetic value

This refers to the sensory, scenic, architectural and creative aspects of the place, area, structure or object. It is often closely linked with the social values. It may consider form, scale, colour, texture and material of the fabric or landscape, and the smell and sounds associated with the place and its use (Australia ICOMOS, 1988).

5.4 Assessing values and significance

This stage is used to assess and discuss the cultural significance of the values recorded during the identification and assessment of cultural significance by the Aboriginal people consulted, and to prepare a statement of significance. The assessment of values is a discussion of what is significant and why. An assessment of values is more than simply restating the evidence collected during the background review and identification of value across each stage of the project. Rather, the assessment should lead to a statement of significance that sets out a succinct summary of the salient values that have been identified.

The assessment and justification in the statement of significance must discuss whether any value meets the following criteria (NSW Heritage Office, 2001):

- Does the subject area have a strong or special association with a particular community or cultural group for social, cultural or spiritual reasons? [Social value]
- Is the subject area important to the cultural or natural history of the local area and/or region and/or state? [Historic value]
- Does the subject area have potential to yield information that would contribute to an understanding of the cultural or natural history of the local area and/or region and/or state? [Scientific/Archaeological value]
- Is the subject area important in demonstrating aesthetic characteristics in the local area and/or region and/or state? [Aesthetic value]

Assessment of each of the criteria listed above should be graded in terms that allow the significance to be described and compared; for example, as high, moderate or low. In applying these criteria, consideration should also be given to:

- Research potential – Does the evidence suggest any potential to contribute to an understanding of the area and/or region and/or state natural and cultural history?
- Representativeness – How much variability (outside and/or inside the subject area) exists, what is already conserved, and how much connectivity is there?
- Rarity – Is the subject area important in demonstrating a distinctive way of life, custom, process, land-use, function or design no longer practiced? Is it in danger of being lost or of exceptional interest?
- Educational potential – Does the Subject area contain teaching sites or sites that may have teaching potential?

5.5 Identified values of the subject area

No specific cultural heritage values, stories or memories the Aboriginal objects or Subject Area have been identified by the Registered Aboriginal Parties to date. The Registered Aboriginal Parties have; however, identified the following cultural values regarding Worimi land as a whole, of which the Subject Area forms part (see Table 12) for significance assessment of Anna Bay PAD 1):

“The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to our ancestors and storylines. “

Mur-Roo-Ma Inc.

Table 12: Identified values of Aboriginal cultural heritage site Anna Bay PAD 1 (AHIMS ID 38-5-0347)

Site details	Anna Bay PAD 1 (AHIMS ID 38-5-0347)
Statement of significance	Not a Aboriginal cultural heritage site
Social or cultural values	Not a Aboriginal cultural heritage site
Historic value	Not a Aboriginal cultural heritage site
Scientific (Archaeological) value	Not a Aboriginal cultural heritage site
Aesthetic value	Not a Aboriginal cultural heritage site
Submissions	Full copies of the submissions made from the RAPs are presented in Appendix C.

Table 13: Identified values of Aboriginal cultural heritage site NBRd 4 (AHIMS ID#38-5-0320)

Site details	NBRd 4 (AHIMS ID#38-5-0320)
Statement of significance	The overall archaeological value of NBRd 4 AHIMS ID#38-5-0320 is considered to be low to moderate. Assessment of each of the criteria for archaeological (scientific) value and significance is presented below.

Social or cultural values	No specific cultural or social values have yet been attributed to the NBRd 4 site specifically, but the wider project area is located close to a noted Aboriginal Place and the broader areas are very significant to local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to their ancestors and storylines.
Historic value	The Subject Area has been used as a small-hold farm property since European settlement in the region in the mid nineteenth century. The Aboriginal cultural heritage site is located north of sand dunes, which are connected to the Port Stephens Local Environmental Plan (LEP) listed "Stockton Beach Dune System", an item of local heritage significance. The heritage curtilage for this item terminates approximately 3 km to the west of the Subject Area. Also, a listed Aboriginal Place at Birubi Point, and a local heritage item, the Birubi Point Cemetery, are located within two kilometres of the Subject Area. The second site of the Hannah (later called Anna) Bay School building is located to the east of the Subject Area, but this is outside its boundaries. Despite the proximity of listed heritage items and places, no historic significance has been attributed to the NBRd 4 Aboriginal cultural heritage site.
Scientific (Archaeological) value	The Aboriginal cultural heritage site has unknown scientific (archaeological) value. It is comprised of surface shell scatters with the potential for subsurface deposit. It may provide additional information regarding Aboriginal life in the local or regional area; however, as it will not be harmed during the proposed works for this project, it has not been further assessed,
Aesthetic value	The Aboriginal cultural heritage site has low aesthetic value.
Submissions	Full copies of the submissions made from the RAPs are presented in Appendix C.

6. The Proposed Development

6.1 Summary of previous land use

The Subject Area contains a number of past land use disturbances which are likely to reduce the potential for any archaeological evidence to survive within the area. Disturbance such as clearing of native vegetation, construction of dwellings and associated buildings, excavation and levelling of the original surface, construction of roads and associated infrastructure, have had an impact on the original soil profile and environment in the northern part of the Subject Area. The southern part of the Subject Area has been bisected by the wide transmission corridor, and the sand dune system in this area is highly dynamic.

Historical aerial photos provide information about previous land use and impact on the ground surface. Details of the historical aerial photos are outlined in Section 2.3.4 and shown in Figure 6.

6.2 Proposed development

The Proponent intends to establish a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The main impacts of the development proposal are depicted in Figure 2 and include:

- The extraction of sand to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.
- This work will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

6.3 Potential for harm

The proposed activity will not harm any known Aboriginal objects or deposits likely to contain Aboriginal objects. The previously recorded Aboriginal cultural heritage site (NBRd 4 AHIMS ID#38-5-0320) will not be impacted by the proposed works, as the section in close vicinity to the Aboriginal cultural heritage site has been already built and there are no significant modifications proposed for this road. The dynamic aeolian sand comprising the dune in the southern extent of the Subject Area will be targeted by the quarrying activities. The area in front of the dune will not be excavated during the works, this area will only be impacted by the operation of equipment and machinery. The RAPs have not identified any heritage values that would be harmed by the proposed activity.

There were no other Aboriginal cultural heritage sites identified with the Subject Area.

Table 14: Impact assessment summary

Site name and number	Type of harm	Degree of harm	Consequence of harm
NBRd 4 (AHIMS ID#38-5-0320)	None	None	No loss of values

6.4 Likely impacted values

The proposed quarry would remove all of the sand within the PAD to ground level. The remainder of the Subject Area will either not be impacted during the proposed project, or has been disturbed to an extent where the likelihood of Aboriginal artefacts existing low. The proposed sand quarry will not have any impact on nearby Aboriginal objects or sites of significance. It is unlikely that changes in the landscape will be evident from those locations.

6.5 Project justification

The primary component of the proposed development comprises sand quarrying. Following the removal of vegetation along the northern face of the dunes within the Subject Area, the aeolian sand is now able to encroach upon the transmission line easement. The emergency extraction of sand from beneath the transmission lines is evidence of the danger this can pose. The quarrying of sand from the Subject Area will assist with keeping the dunes out of the transmission easement.

Given the fact that no Aboriginal objects, places or values will be harmed by the proposed works, there is no justification for redesigning the Project.

7. Avoiding and Minimising Harm

7.1 Conservation Principles and Management Framework

The two founding principles behind the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (Office of Environment and Heritage, 2011) are ecologically sustainable development and intergenerational equity. These principles hold that “the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations”.

The strong emphasis, as in the Burra Charter, is to quantify and understand the heritage values of a place, a site, or an object and exhaust avenues of avoiding harm to those values. If harm cannot be avoided then there must be consideration and implementation of strategies to minimise harm (Office of Environment and Heritage, 2011).

It follows that the hierarchy for consideration in regards to management strategies available for surface stone artefacts and subsurface stone artefacts and areas of archaeological potential, fall into four general categories, in order of preference from a conservation perspective:

- avoidance and in-situ conservation;
- partial avoidance and partial in-situ conservation (includes partial harm);
- harm caused with mitigating circumstances such as collection or salvage; and
- unmitigated harm.

The four general categories (described above) have been considered in the following subsections with regard to both direct impacts (e.g. surface disturbance) and indirect impacts (e.g. monitoring activities).

The management and mitigation measures have been prepared in consideration of comments received from the RAPs during the consultation process. These comments include those related to cultural considerations surrounding salvage works and the handling of artefactual materials, as well as the cultural significance of all Aboriginal cultural heritage sites. All comments received from the RAPs are considered in Section 4.

7.2 Designing to avoid

The proposed design will not impact on any known Aboriginal objects, places or values.

7.3 Justifying harm

The proposed development, which involves the extraction of sand to ground level, removal of vegetation, minor haul road upgrades, and construction of buildings, would directly impact on the soil profile of the Subject Area, although the degree of impact would vary across it.

No harm to Aboriginal objects is proposed.

The archaeological test excavations of a potential area of high archaeological sensitivity, Anna Bay PAD 1 (AHIMS ID 38-5-0347) did not identify any Aboriginal objects. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site.

The following previously recorded AHIMS registered site that occurs within the Subject Area will not be adversely affected by the proposed works:

- NBRd 4 (AHIMS ID #38-5-0320).

7.4 Consideration of management and mitigation strategies

Though no harm to Aboriginal objects is proposed, the management and mitigation measures in Table 15 should be considered to ensure continued compliance with the National Parks and Wildlife Act 1974. It is considered that considering no Aboriginal objects, places or values will be harmed by the proposed works, an Aboriginal Cultural Heritage Management Plan as suggested by the RAPs in Section 3, is not warranted.

Table 15: Management and mitigation strategies

Management Risk / Impacted Value	Strategies considered	Response
Management Risk – Compliance and Unexpected Finds (excluding human remains)	Communication to employees, site visitors, contractors and landowners	• All workers should be inducted into the Subject Area so they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> and any conditions of any future consent with respect to Aboriginal heritage prior and during and after construction activities. • In the unlikely event of the identification of artefacts within the Subject Area, work in the surrounding area is to stop immediately. • A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site. • In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material. • If the material is an Aboriginal object, the Proponent will notify: ○ the BCD's Enviroline on 131 555; and ○ Representatives of the RAPs. • Facilitate, in co-operation with the appropriate authorities and the RAPs: ○ The recording and assessment of the finds ○ Compliance with any legal requirements and BCD directions ○ The development and implementation of appropriate management strategies based on an assessment of significance of the finds.

Management Risk / Impacted Value	Strategies considered	Response
		• Recommencement of ground disturbance works may only resume once legal requirements are fulfilled
Management Risk – Unexpected Finds – human remains	Stop work and follow procedure for discovery of suspected human remains	• All workers should be inducted into the Subject Area so they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> and any conditions of consent prior and during and after construction activities • In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately. • The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. • The NSW Police must be contacted immediately. • No further action is to be undertaken until the NSW Police provide written notification to the Proponent. • If the skeletal remains are identified as Aboriginal, The Proponent or their agent must contact: ▪ the BCD's Enviroline on 131 555; and ▪ representatives of the RAPs. • No works are to continue until the BCD provides written notification to the proponent or their Agent. • An Aboriginal Heritage Impact Permit may be required to manage human remains.

7.5 Consideration of the principles of ecological sustainable development

Section 5(vii) of the EP&A Act requires proponents to consider the key principles of ESD in the design of their projects. The principles of ESD are defined within the NSW *Protection of the Environment Administration Act, 1991*. This Act defines the precautionary principle and the principles of inter-generational equity, conservation of biological diversity and ecological integrity. The precautionary principle is defined as:

"If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation".

Table 16 considers the key principles of ESD with respect to the results of the literature review, Aboriginal heritage survey results and significance assessment contained within this report.

Table 16: Preliminary consideration of the Environmental Impact Assessment and ESD Guidelines

Principles of Environmental Impact Assessment and ESD Guidelines	ESD Assessment
A fundamental consideration for conservation of biological diversity and ecological integrity.	The assessment has considered conservation of cultural heritage integrity by:

Principles of Environmental Impact Assessment and ESD Guidelines	ESD Assessment
Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment.	- Utilising a previously formed haul road to access the sand deposit. - Avoiding Aboriginal cultural heritage site NBRd 4 (AHIMS ID #38-5-0320).
Consideration of intergenerational equity.	The assessment has considered intergeneration equity by: Undertaking community consultation with RAPs regarding the cultural values within the Subject Area and the management of Aboriginal cultural heritage sites and Aboriginal heritage values.
Where risk of serious or irreversible harm and lack of scientific knowledge of the nature of environmental harm combine, the precautionary principle applies. Where there is risk of serious or irreversible harm, it is necessary to establish whether there is adequate scientific knowledge of the subject to evaluate the perceived threat.	This assessment has undertaken an ACHA, which initially identified information gaps and sensitive areas where further information was required to evaluate the potential impacts of the project. Further investigation through archaeological test excavation and further Aboriginal community consultation within the Subject Area was undertaken through an AHIP to “acquire adequate scientific knowledge of the subject to evaluate the perceived threat.” As a result of these further investigations, no additional Aboriginal objects or cultural values were identified within the Subject Area.
An assessment of the risk-weighted consequences of various options.	Management and mitigation are provided in Section 7.4.

8. Conclusions and recommendations

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd, to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to facilitate the development of the Anna Bay Sand Quarry at 4226 Nelson Bay Road, Anna Bay (the Project), a designated development, under Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act). As a designated development, the Secretary's Environmental Assessment Requirements (SEAR 1172) require that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage be undertaken.

The ACHA was carried out in accordance with the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (NSW Office of Environment and Heritage 2011). The survey program involved consultation with Registered Aboriginal Parties in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* and their participation in the field survey (details of which are in Appendix B). The survey resulted in the identification of a PAD within a sensitive landscape feature consisting of sand dune that was considered to potentially contain Aboriginal objects extending from surrounding midden sites.

An Aboriginal Heritage Impact Permit (AHIP) was applied for in April 2019 under s.90 of the *National Parks and Wildlife Act 1974* to allow harm to Aboriginal objects by test excavation at the Anna Bay PAD-1 (AHIMS ID#38-5-0347) Aboriginal cultural heritage site. The AHIP (C0004974) was issued on 8 July 2019.

The test excavation was carried out over three days from 23 to 25 July 2019. Sixteen test pits, measuring 50 cm x 50 cm, were excavated. No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site. An Aboriginal Site Impact Recording Form was submitted to BCD advising of the updated status "Not a Site" (Annex E in Appendix B)

No further investigation or impact assessment is required. Works may proceed with caution without an Aboriginal Heritage Impact Permit. Based on community consultation with the RAPs for the Project, and with the completion of this ACHA by Niche, the following recommendations have been made:

Recommendation One

- All workers should be inducted into the Subject Area so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of any future consent with respect to Aboriginal heritage prior and during and after construction activities.

Recommendation Two

- In the unlikely event of the identification of artefacts within the Subject Area, work in the surrounding area is to stop immediately.
- A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site.
- In consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material.
- If the material is an Aboriginal object, the Proponent will notify:
 - the BCD's Enviroline on 131 555; and
 - representatives of the RAPs.
- Facilitate, in co-operation with the appropriate authorities and the RAPs:

- o The recording and assessment of the finds
 - o Compliance with any legal requirements and BCD directions
 - o The development and implementation of appropriate management strategies based on an assessment of significance of the finds.
- Recommencement of ground disturbance works may only resume once legal requirements are fulfilled

Recommendation Three

- All workers should be inducted into the Subject Area so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* and any conditions of consent prior and during and after construction activities
- In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately.
- The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm.
- The NSW Police must be contacted immediately.
- No further action is to be undertaken until the NSW Police provide written notification to the Proponent.
- If the skeletal remains are identified as Aboriginal, The Proponent or their agent must contact:
 - o the BCD's Enviroline on 131 555; and
 - o representatives of the RAPs.
- No works are to continue until the BCD provides written notification to the proponent or their Agent.
- An Aboriginal Heritage Impact Permit may be required to manage human remains.

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Appendix A: Archaeological Report



Anna Bay Sand Quarry

4226 Nelson Bay Road, Anna Bay NSW

Archaeological Report

Prepared for Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd

Port Stephens Council Local Government Area

Authors: Dr Morgan Disspain, Balazs Hansel, Renee Regal and Clare Anderson

Consultancy: Niche Environment and Heritage

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Cover photograph: Looking east towards proposed sand quarry area (Niche 2018)

Executive Summary

Niche Environment and Heritage (Niche) was commissioned by Tattersalls Lander Pty (the Proponent), to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to facilitate the development of the Anna Bay Sand Quarry at 4226 Nelson Bay Road, Anna Bay (the Subject Area). The sand quarry is a designated local development, under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act) (the Project). As a designated local development, the Secretary's Environmental Assessment Requirements (SEAR 1172) provide that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage, should be undertaken.

This document, the Archaeological Report (AR), forms a supporting attachment to the ACHA Report. It provides an assessment of the archaeological values and potential archaeological impacts of the proposed activity. It has been carried out in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change and Water NSW, 2010) (Code of Practice).

The ACHA process and the AR the assessment included background archaeological and historical investigation, ongoing consultation with the Registered Aboriginal Parties (RAPs), and an archaeological survey that included representatives from Mur-roo-ma Incorporated, Worimi Traditional Owners Indigenous Corporation, Karuah Indigenous Corporation, Worimi Local Aboriginal Land Council, and Nur-Run-Gee Pty Ltd.

During the survey, it was determined that the southern section of the Subject Area contains an area of high sensitivity within a sand dune system, which may be a continuation of a previously recorded Aboriginal cultural heritage site within the Subject Area... The area of sensitivity was named Anna Bay PAD-1 (AHIMS ID#38-5-0347) and would be impacted by the proposed activity.

Subsequently, an Aboriginal Heritage Impact Permit (AHIP) was applied for in April 2019 under s.90 of the *National Parks and Wildlife Act 1974* to allow harm to Aboriginal objects by test excavation at the Anna Bay PAD-1 (AHIMS ID#38-5-0347) Aboriginal cultural heritage site. The AHIP (C0004974) was issued on 8 July 2019.

The test excavation was carried out over three days from 23 to 25 July 2019. Sixteen test pits, measuring 50 cm x 50 cm, were excavated. No Aboriginal objects were identified. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site. An Aboriginal site impact recording form has been lodged to indicate the locations status as "Not a site".

Summary of potential impacts

The proposed activity will not harm any Aboriginal objects or deposits likely to contain Aboriginal objects. The Registered Aboriginal Parties have not identified any heritage values that would be harmed by the proposed activity.

Conclusion and recommendations

No further investigation or impact assessment is required. Works may proceed with caution without an Aboriginal Heritage Impact Permit. Based on community consultation with the RAPs for the Project, and with the completion of this ACHA by Niche, the following recommendations have been made:

- All workers should be inducted into the Subject Area so they are made aware of their obligations under the *National Parks and Wildlife Act 1974* prior and during and after construction activities.
- The following Find Procedure should be put in place as a minimum response in the unlikely event of the identification of artefacts within the Subject Area:
 - work in the surrounding area is to stop immediately;
 - a temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site;
 - in consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material; and
- Should the material be confirmed as an Aboriginal object or archaeological site, Facilitate, in co-operation with the appropriate authorities and the RAPs:
 - The recording and assessment of the finds
 - Compliance with any legal requirements and BCD directions
 - The development and implementation of appropriate management strategies based on an assessment of significance of the finds.
 - Recommencement of ground disturbance works may only resume once legal requirements are fulfilled and an Aboriginal Heritage Impact Permit will be required
- In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately and:
 - The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm.
 - The NSW Police must be contacted immediately.
 - No further action is to be undertaken until the NSW Police provide written notification to Tattersalls Lander Pty Ltd.
 - If the skeletal remains are identified as Aboriginal, Tattersalls Lander Pty Ltd or their agent must contact:
 - the Biodiversity and Conservation Division ((BCD), of the Department of Planning, Industry and Environment (DPIE), previously known as the Office of Environment and Heritage (OEH)) Enviroline on 131 555; and
 - Representatives of the RAPs.
 - No works are to continue until the BCD provides written notification to the proponent or their Agent.

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1. Introduction

Hay Enterprises NSW Pty Ltd (the Proponent) intends to establish the Anna Bay Sand Quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period (the Project). The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380) (the Subject Area) within the coastal, semi-rural locality of Anna Bay. It is situated 12 km southwest of Nelson Bay and 25 km northeast of Newcastle Airport in the Port Stephens region of NSW, in the Parish of Tomaree, in the County of Gloucester, in the Port Stephens Council Local Government Area (LGA) (Figure 1, Figure 2).

The proposed Anna Bay Sand Quarry will be assessed as a Designated Development as per Schedule 3 subclauses 19(1) (c) (iii) and 19(1) (c) (VI) of the *NSW Environmental Planning and Assessment Act, 1979* (EP&A Act) and is being considered by Port Stephens Council under Part 4 of the EP&A Act. Secretary's Environmental Assessment Requirements (SEARs) (SEAR #1172) were issued on 23 October 2017 for the project and required that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological) should be conducted. This included evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage. This cultural heritage assessment was undertaken to inform an Environmental Impact Statement (EIS).

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty Ltd on behalf the Proponent to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform the EIS for the Project. This Archaeological Report (AR) presents the results of an Aboriginal archaeological assessment for the proposed development. The AR is an integral part of the ACHA and will be included as an Appendix in the ACHAR.

Niche has prepared this archaeological report in accordance with the following guidelines as per the SEARs:

- *Aboriginal cultural heritage consultation requirements for proponents 2010* (OEH 2010).
- *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (Department of Environment, Climate Change and Water (DECCW) NSW 2011).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW 2010).
- *Due Diligence Code of Practice for the Protection of Aboriginal Objects in NSW* (OEH).
- *The Burra Charter (The Australia ICOMOS charter for places of cultural significance)*.

The objectives of the archaeological report were to identify whether Aboriginal sites, objects or places are present within the Subject Area. If present, the assessment aimed to determine whether these would be impacted by the proposed works and provide appropriate mitigation and management recommendations in accordance with the *National Parks and Wildlife Act 1974 (NSW)* (NPW Act). This report fulfils requirement for a test excavation report to be written as set out in the Aboriginal Heritage Impact Permit (AHIP) number: C0004974 (Annex D).

2. Investigators and contributors

The contributors to this archaeological report and their project roles are listed in Table 1.

Table 1: Contributors-affiliations and roles (in alphabetical order)

Contributor	Affiliation	Role	Qualification
Niche Staff			
Clare Anderson	Niche	Heritage Consultant, Author	BA (Hons)
Dr Morgan Disspain	Niche	Senior Heritage Consultant, Project Manager post-January 2019, Excavation director, Author	BArch. (Hons), PhD
Wade Goldwyer	Niche	Heritage Technical Advisor, Test excavation	
Viki Gordon	Niche	Heritage Consultant, Field survey supervisor	(BA Anc Hist Grad Dip Arch),
Balazs Hansel	Niche	Heritage Consultant, Project Manager pre-January 2019, Author	MArch, MHist
Matt Harris	Niche	GIS and mapping	
Dr Ross Jenkins	Niche	GIS and Mapping	
Renee Regal	Niche	Heritage Consultant, Author	BA (Hons)
Registered Aboriginal Parties			
Leonard Anderson	Nur-Run-Gee Pty Ltd	Survey, Review of documents	
Paul Boyd	Didge Ngunawal Clan	Review of documents	
Lilly Carroll	Didge Ngunawal Clan	Review of documents	
Chris Collinson	Nur-Run-Gee Pty Ltd	Test Excavation	
David Feeney	Karuah Indigenous Corporation	Survey, Test Excavation. Review of documents	
Steven Hickey	Widescope Indigenous Group	Review of documents	
Darleen Johnson-Carroll	Murra Bidgee Mullangari Aboriginal Corporation	Review of documents	
Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Review of documents	
David Kirk	Mur-Roo-Ma Incorporated	Test excavation	
Luke Knight	Worimi Traditional Owners Indigenous Corporation	Test Excavation	
Brendann Lilley	Worimi Local Aboriginal Land Council	Test Excavation	
Jamie Merrick	-	Review of documents	
Deidre Perkins	Divine Diggers Aboriginal Cultural Consultants	Review of documents	

Contributor	Affiliation	Role	Qualification
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Steve Talbott	Gomeroi Namoi	Review of documents	
Candy Lee Towers	Worimi Traditional Owners Indigenous Corporation	Survey, Review of documents	
Bec Young	Mur-Roo-Ma Incorporated	Survey, Review of documents	

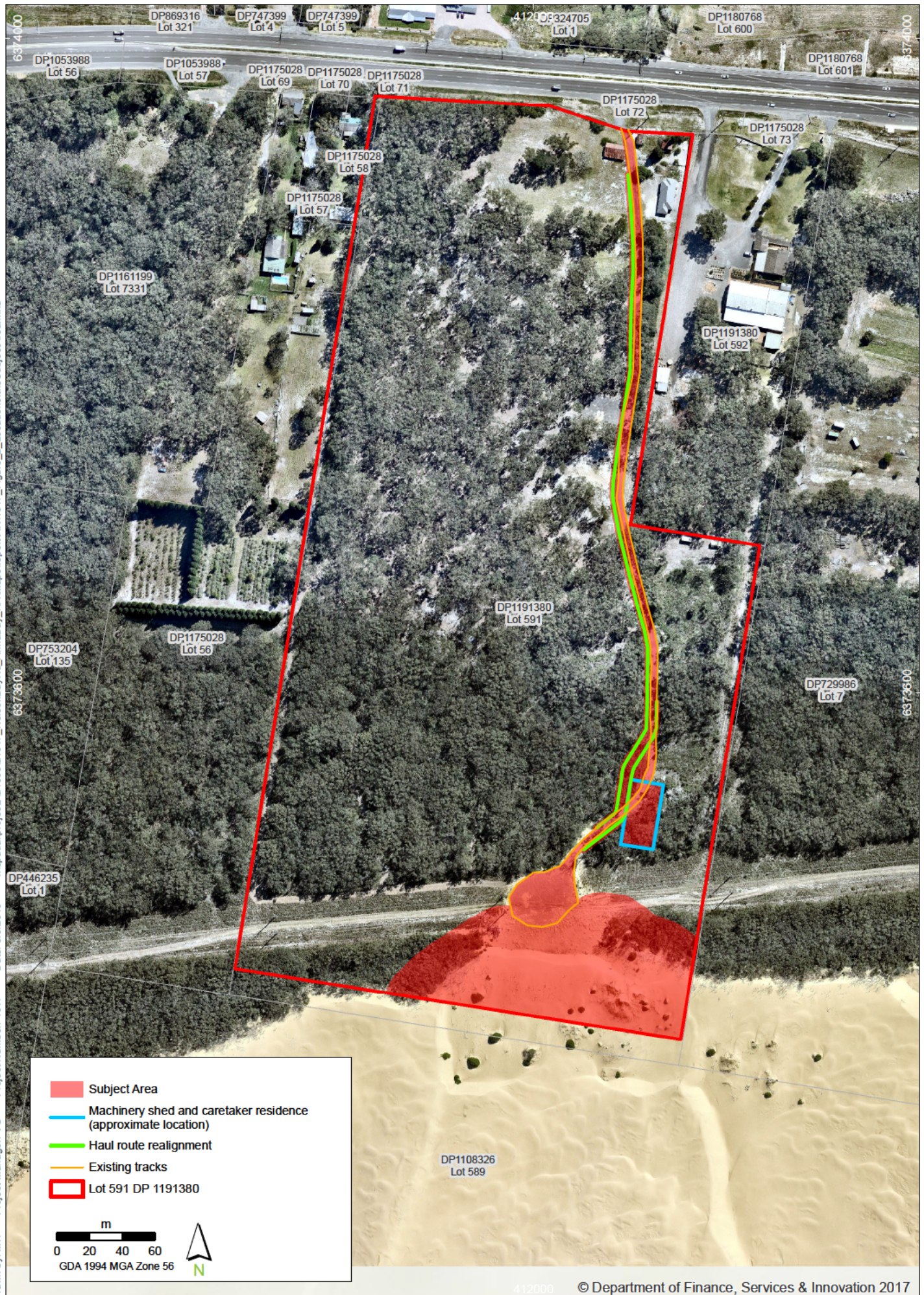
3. Description of development proposal

The Proponent intends to establish a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The main impacts of the development proposal will be:

- The extraction of sand from the dunes to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.

This work will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.





Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location of the Subject Area

4. Previous archaeological work

4.1 Heritage Registers

4.1.1 Aboriginal Heritage Information Management System (AHIMS)

An extensive Aboriginal Heritage Information Management System (AHIMS) search was conducted on 18 January 2018 (AHIMS Client ID: 322781) centred on the Subject Area (Figure 4, Annex A).

The AHIMS search identified one Aboriginal site within the Subject Area, known as NBRd 4 (AHIMS ID# 385-0320). The Aboriginal cultural heritage site comprises shell fragments on the ground surface, with the high possibility of the presence of more shell in the area as part of an extensive shell-midden. The registered site card for this Aboriginal cultural heritage site is attached at Annex A. Thirteen (13) additional Aboriginal cultural heritage sites were located outside the Subject Area within a 1 km distance, including surface stone artefact scatters, shell middens with stone artefacts, and potential archaeological deposits (PADs). The AHIMS sites are summarised in Table 2.

Table 2: Previously recorded AHIMS sites within 1 km of the Subject Area

AHIMS No.	Site Name	Eastings	Northings	Status	Site Features
38-5-0121	Anna Bay 1	411400	6372400	Valid	Midden: Artefacts and shell
38-5-0198	Anna Bay	412500	6372550	Valid	Artefact
38-5-0223	Tomaree 7	412454	6373889	Partially Destroyed	Artefacts and shells
38-5-0250	Anna Bay 1, NBR	411480	6373850	Valid	Artefacts and shell
38-5-0320	NBRd 4	412046	6373942	Valid	Shell
38-5-0321	NBRd 5	411292	6373875	Valid	Shell
38-5-0319	OFOC5	412500	6373988	Partially Destroyed	Shell
38-5-0312	NBR3/2 artefact scatter	412210	6373957	Valid	Artefact
38-5-0310	NBR3/3 shell midden	412111	6373980	Valid	Artefact and shell
38-5-0311	NBR3/ PAD1	412110	6373980	Valid	Potential Archaeological Deposit (PAD)
38-5-0327	Ausgrid Anna Bay IF1	412517	6373648	Valid	Artefact
38-5-0324	NRB3/PAD3	411750	6373780	Valid	Potential Archaeological Deposit (PAD)
38-5-0325	NBR3/PAD4	411800	6373784	Valid	Potential Archaeological Deposit (PAD)
38-5-0331	WCL1403	412543	6372831	Valid	Artefact

The frequencies of Aboriginal cultural heritage site types within the search area are consistent with regional trends identified during previous studies within close proximity to the current assessment (for example (McCardle Cultural Heritage, 2016; McCardle Cultural Heritage Pty Limited, 2015). Aboriginal cultural heritage sites are variable distances from permanent water sources throughout the AHIMS search

area, with the majority located approximately 1 km from the ocean and approximately 2.5 km from Tilligerry Creek (Figure 3).

4.1.2 Other heritage registers

Searches of the following databases were undertaken by Niche on 31 January 2018.

- Australian Heritage Database – provides a list of items on the World Heritage List
- National Heritage List (NHL) - provides protection to places of cultural significance to the nation of Australia.
- Commonwealth Heritage List (CHL) - comprises natural, Aboriginal and historic heritage places owned and controlled by the Commonwealth.
- State Heritage Register (SHR) - items that have been assessed as being of State Significance to New South Wales and includes Aboriginal Places.
- State Heritage Inventory (SHI) - contains items that are listed on Local Environmental Plans and/or on a State Government Agency's s.170 registers.

The following documents were also considered:

- Port Stephens Local Environmental Plan (LEP)
- Port Stephens Development Control Plan (DCP) 2014

The Port Stephens DCP outlines detailed local provisions for all land within the Port Stephens LGA. These guidelines are in addition to the provisions of the Port Stephens LEP. Section B8 of the DCP states requirements that apply to all development within heritage items and heritage conservation areas and also specific, unique requirements for development within each particular area. The DCP contains controls for any developments that may impact on a heritage item.

No listed heritage items are located within the Subject Area (Table 3); however, a number of heritage items are located nearby. Further consideration of historic heritage items is provided in a separate Heritage Impact Assessment (Niche 2018).

Table 3: Heritage registers search results

Heritage Registers	Heritage Items in the Subject Area	Nearby Heritage Items
World Heritage List	None	None
National Heritage List	None	None
Commonwealth Heritage List	None	None
State Heritage Register	None	Birubi Point Aboriginal Place
State Heritage Inventory	None	Birubi Point Cemetery (Item ID:12)
Local Environmental Plan	None	Stockton Beach Dune System (Item ID: 134)
Development Control Plan	None	DCP Controls apply to the above heritage items.

4.1.2.1 Birubi Aboriginal Place

Birubi Point, which is located 1.4 km the east of the Subject Area, is a registered Aboriginal Place due to its continued association with the Worimi people. It was registered as an Aboriginal Place 5062849 (file number 07/18962 & DOC 07/50249 & DOC1) under the NPW Act in 2007. It is a traditional Aboriginal ceremonial and burial site, which contains extensive archaeological material considered important to the teaching of the current and future generations about the local Aboriginal culture. This site is connected

with the Worimi Conservation Lands, which are a joint management of a number of National Parks and Conservation Areas. This place provides valuable information regarding the archaeological potential of the Subject Area due to its proximity and context.

4.1.2.2 Birubi Point Cemetery

Birubi Point Cemetery (Plate 1) is located approximately 2.3 km from the Subject Area. Birubi Point Cemetery was in use between 1876 and 1996 and contains the graves of early settlers to the area, as well as shipwrecked persons, some of who were unidentified. The cemetery is located adjacent to the original lot of land settled by the Blanch family in the 1950s. The point on which the cemetery is located was known as Cemetery Point, until the name was officially changed in 1976; it is now located within the lands of the Birubi Point Aboriginal Place. The first internment in 1876 was that of Lucy Blanch who was an Anna Bay pioneer. The cemetery contains a layout plan on a plaque and includes a list of all the known burials within the cemetery, numbering 88 internments.

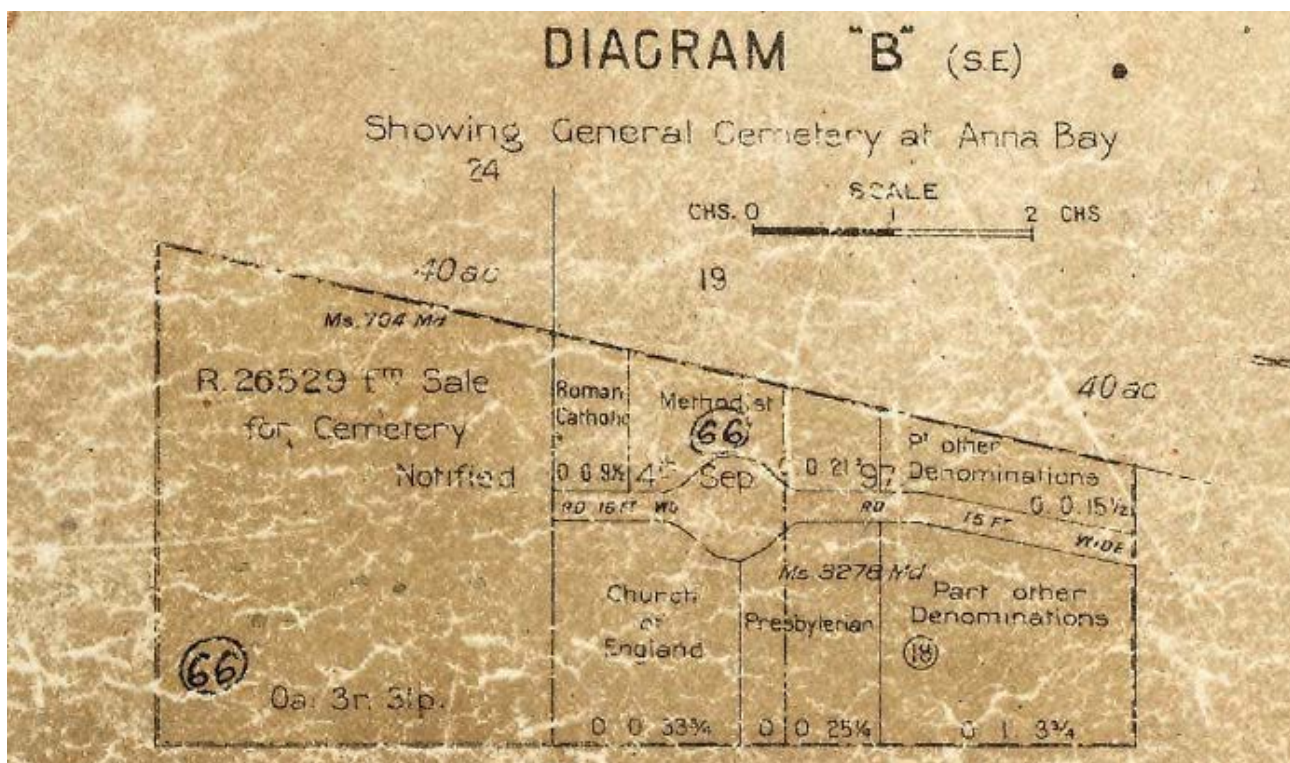


Plate 1: Insert from the 1967 Tomaree Parish map showing the layout of the Birubi Cemetery.

4.1.2.3 Stockton Beach Dune System

Stockton Beach dune system is the largest moving coastal land mass in the southern hemisphere, and stretches from Stockton to Anna Bay covering a distance of approximately 25 kilometres in length. The dunes are moving inland at a rate of about one metre per year, following their destabilisation in the nineteenth century by severe storms and cattle grazing. According to the Register of the National Estate, the entire bight (stretching from the Hunter River Estuary to Birubi Point in the north) is of significance for its unique natural ecosystem (RNE Place ID: 19510).

As a result of the shifting sand sheet, Aboriginal midden sites, burials and education sites important to the Worimi peoples, as well as World War II fortifications, are periodically covered and revealed by the moving sands. These sand dunes are directly adjacent to the Subject Area, and are encroaching northwards from the southern boundary of the Subject Area. Their dynamic nature means that archaeological material may exist within the Subject Area subsurface. The defence lines that were constructed on Stockton Beach during

World War II were part of the Northern Defence Line, which was a part of the nationwide response to the Japanese attacks on Darwin and submarines entering Sydney and Newcastle harbours (OEH 2015:27). The defensive tank traps were set up along the entire line of the beach, and infantry-manned heavy and light artillery stations were established at the southern end of the beach at Fern Bay. Tank traps which were removed from their emplacements now form the boundaries of an overflow car park just below Birubi Point at the northern end of the beach. The northern end of the beach, located south of Birubi Point was used as a bombing and military training location during World War II (OEH 2015:27). The weapons range, which was established during the war with an area approximately totalling 400 hectares, including an area directly to the south of the Subject Area. The area continued to be used as a RAAF weapons range until at about 1965 (Plate 2). Unexploded ordinance is still recovered from the sand dunes and are subject to protocols from the NSW Police and Department of Defence (OEH 2015:27).

Located within the central section of the beach, behind the fore dune, are a group of eleven corrugated iron structures with gable or skillion roofs. They have been named "Tin City" by the locals. The original huts date to the 1940s and 50s and were constructed for use by recreational fishermen in the area. The majority of the huts that are currently standing were constructed in the 1970s and 1980s, with the most recent hut constructed in 1992. None of the original huts from the 1940s and 1950s are still standing, but those that remain continue to be used by fishermen (OEH 2015:28). The remains of destroyed huts on the southern and central areas of the beach remain under the shifting sand dune, subject to exposure by local sand drift.

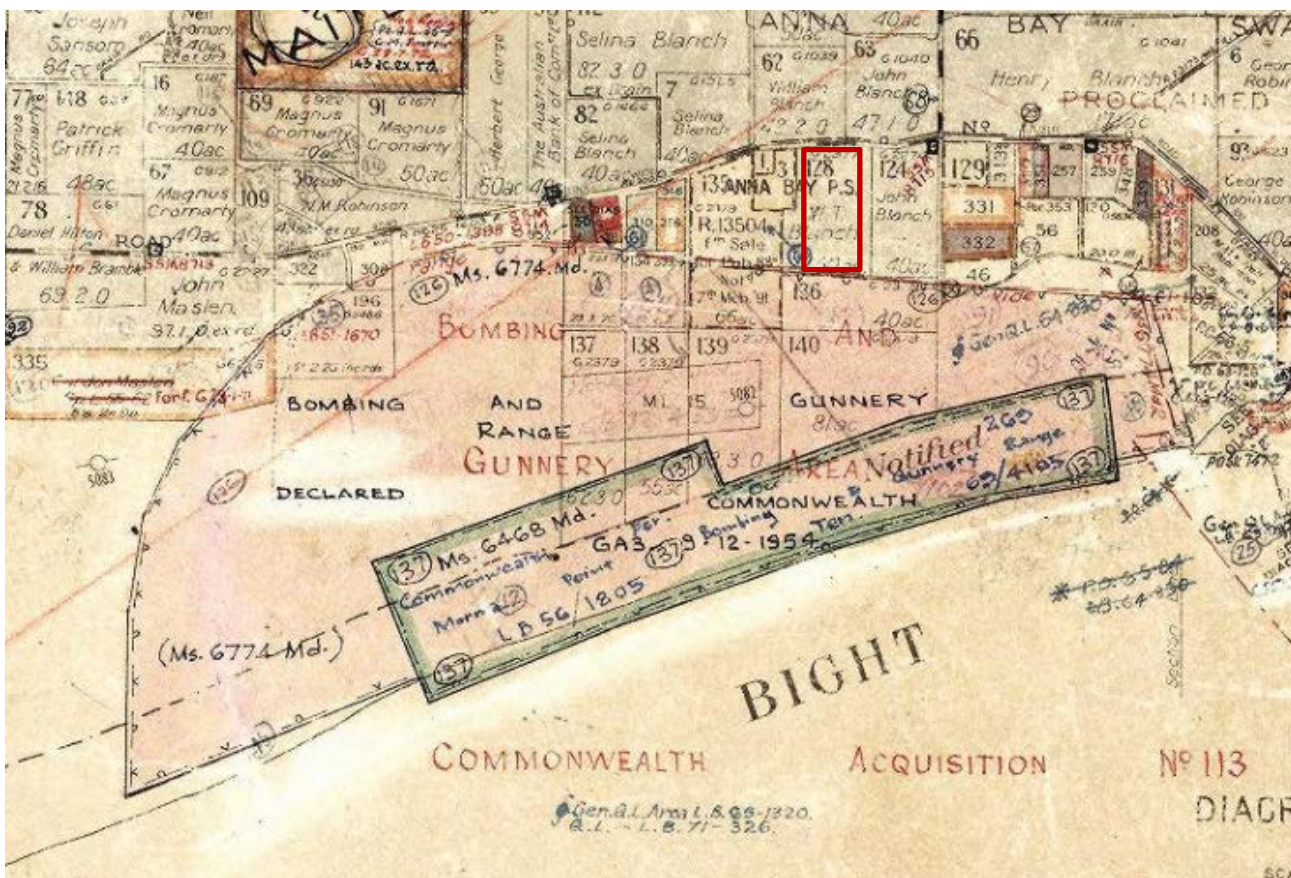
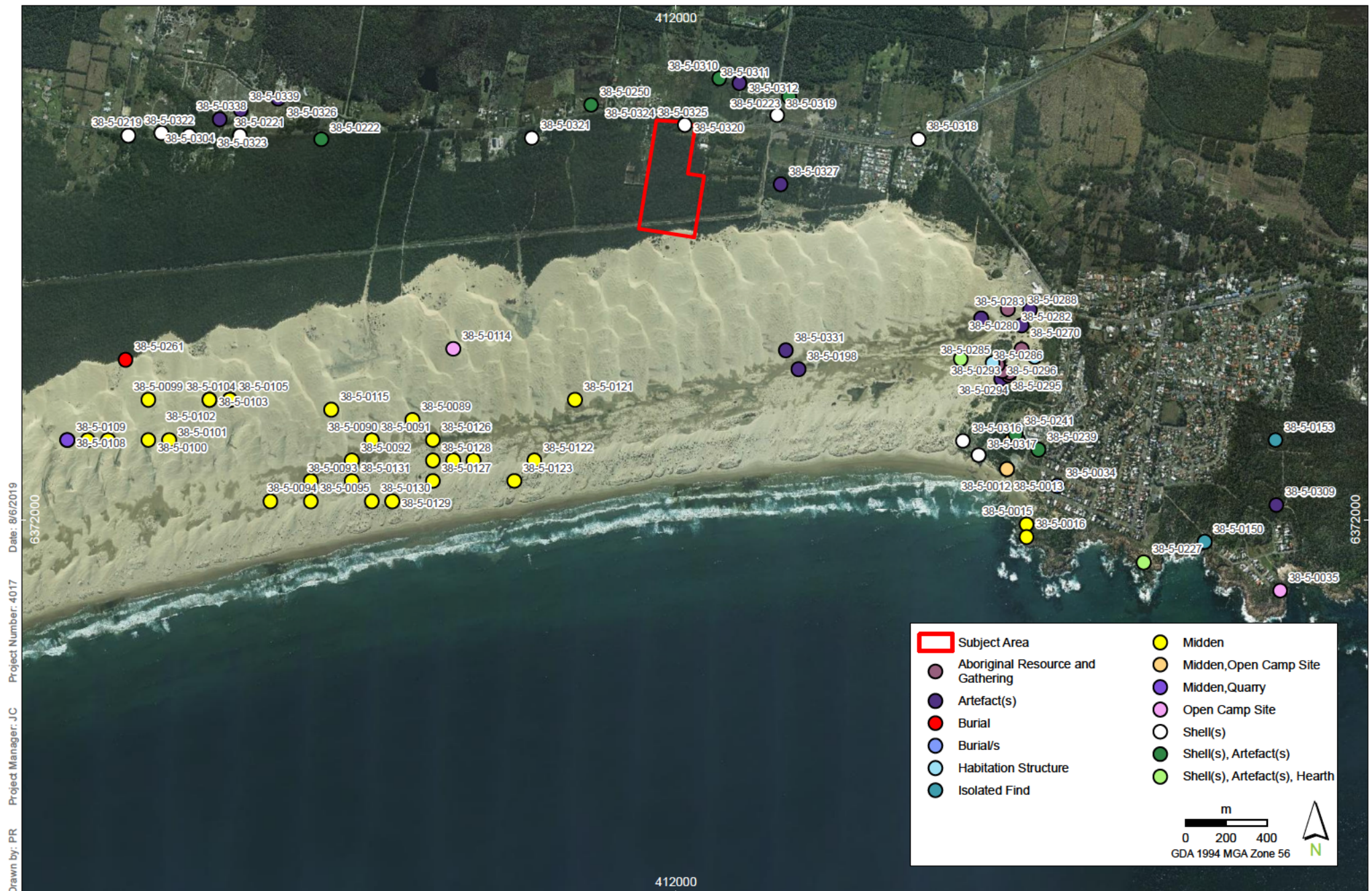


Plate 2: 1967 Tomaree parish map outlining "bombing and gunnery range" abutting onto the Subject Area (indicative location shown in red). (Source: LPI)



4.2 Previous archaeological assessments of the Subject Area

4.2.1 Niche (2017)

A field survey of the Subject Area was undertaken by Niche in 2017 and forms part of the ongoing assessment of this report. The area contains landscape features which suggest a potential for archaeological deposits (proximity to a waterway and containing a ridgeline within 200 m of waters).

4.2.2 Aboriginal Objects Due Diligence Assessment (Niche 2018)

A field assessment was completed by Viki Gordon (Senior Heritage Consultant), Jamie Merrick (Sites Officer Worimi Local Aboriginal Land Council), Lennie Anderson (Nu-Run-Gee Pty. Ltd.) and Rebecca Young (Mur-Roo-Ma Incorporated) on 23rd January 2018. The field assessment was undertaken to determine whether the project design would impact any Aboriginal objects.

Though the field assessment did not locate any surface Aboriginal objects it is the conclusion of the assessment that subsurface Aboriginal objects may be present and that further background research and inspection will need to be carried out. This conclusion is drawn due to:

- the close proximity to the proposed works to a number of Aboriginal cultural heritage sites (Figure 1) registered on the Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS),
- the presence of a sand dune system which has the potential to comprise Aboriginal objects,
- cultural information for Aboriginal representatives in relation to large shell middens in the general vicinity of the Subject Area,
- the relatively undisturbed nature of the vegetation,
- the close proximity of fresh water sources, and
- the undisturbed nature of the sand dune.

The above features, where relatively undisturbed, are identified in the Due Diligence Code of Practice for the protection of Aboriginal Objects in NSW as requiring further investigation and impact assessment if they cannot be avoided. Consequently, the recommendation is made that Tattersalls Lander Pty Ltd complete an Aboriginal Cultural Heritage Assessment with the possibility to apply for an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974* as outlined in the Secretary's Environmental Assessment Requirements (SEARs).

4.2.3 Historical Impact Assessment (Niche 2018)

Niche Environment and Heritage (2018) completed a historic impact assessment for the Subject Area. The assessment concluded that:

- There were no listed heritage items within, or directly adjacent to, the Subject Site.
- The subject site had been employed as a small farm-holding since the mid-nineteenth century, although no heritage significant built fabric has been identified at the site;
- No areas of archaeological potential for the recovery of heritage significant relics were identified at the subject site.
- The proposed works were therefore assessed not to have impact on any heritage significant items or archaeological relics. No further non-Aboriginal (historic) heritage constraints for the proposed works were identified.

4.3 Regional overview of previous archaeological investigations within the Port Stephens Council Local Government Area

Previous investigations with relevance to the Subject Area are summarised in Table 4 below.

Table 4: Previous archaeological investigations relevant to the Subject Area

Assessment author and year	Summary of assessment
Dean-Jones (1990)	The most significant study carried out in the Newcastle Bight was carried out by Pam Dean-Jones. Although the hard copy could not be accessed among the archaeological literature. Dean-Jones (1990) identified numerous sites across the Port Stephens geomorphic zone. This project is relevant to the Subject Area in that it contributes to the predictive model for the region.
OEH, Board of Management for the Worimi Conservation Lands (2015)	In 2015, the Plan of Management was jointly adopted by the Minister of the Environment and the Minister for Lands and Water. The report was prepared by the Board of Management for the Worimi Conservation Lands with staff of the Lower North coast Region of the NPWS. This project is relevant to the Subject Area in that it contributes to the predictive model for the region and it provides background information about cultural values of the surrounding area.
Eric Martin and Associates (2002)	A Conservation Management Plan (CMP) was commissioned by the NSW National Parks and Wildlife Service (NPWS) in 2002 to provide a basis for the ongoing conservation and management of Tomaree Head. Tomaree Head is situated at the southern entrance to Port Stephens and is of significance to Aboriginal people. The CMP concludes that the NPWS as the custodian and landlord of Tomaree, is responsible for the conservation, management of Tomaree Head, and to increase public access to it as a state significant prominent landmark with WWII fortifications. This project is relevant to the Subject Area in that it contributes to the predictive model for the region.
McCardle Cultural Heritage (2015a)	A due diligence assessment of 781 Marsh Rd, Port Stephens was undertaken by McCardle Cultural Heritage in 2015. It included both a desktop assessment and a field survey (which included the Subject Area). The subject area was situated within a floodplain and was assessed as having low sensitivity due to clearing and past land use impacts. This project is relevant to the Subject Area in that it contributes to the predictive model for the region.
McCardle Cultural Heritage (2015b)	Additionally McCardle Cultural Heritage (2015b) conducted a Salvage AHIP excavation at 108 Nelson Bay Rod, Bobs Farm to Anna Bay (Cromarty Lane to Port Stephens Drive). They concluded that the archaeological evidence recovered from within the study area, can be interpreted in relation to the traditional way of life that was practiced by Aboriginal people. They also concluded that Aboriginal cultural heritage site 38-5-0310, which may extend into the Subject Area, was extremely complex with numerous locations with few pieces of shell with high stone artefact densities. This project is relevant to the Subject Area because it is located within a similar landform, but is closer to permanent water sources. It contributes to the predictive model for the region.
Australian Museum Business Services (AMBS) (1997)	The AMBS study aimed to examine and assess the concept of representativeness for known Aboriginal archaeological resources on the Port Stephens Council Plain, assess the planning framework to achieve better outcome for heritage management and to produce guidelines for the recognition of silcrete artefacts recorded in high numbers around the Port Stephens Council Plain. AMBS provided an overview of the archaeological works completed and also raised problems and issues in relation to techniques to identify archaeological site patterns and understanding the nature and frequency of past human occupation of the area. The assessment concluded that there is a lack of a satisfactory systems for defining the representativeness and modelling of the spatial distribution of archaeological sites on the Port Stephens Council Plain. Consequently, it concludes that research models and methodologies should be developed, and adequately

Assessment author and year	Summary of assessment
	tested, to ensure that the archaeological patterns of the area are systematically developed and would be comparable to others within the Port Stephens Council Plain. This project is relevant to the Subject Area in that it contributes to the predictive model for the region.

5. Landscape context

Consideration of the landscape is essential to the definition and interpretation of past Aboriginal land use across a landscape and is a requirement of any Aboriginal archaeological and cultural heritage investigation (DECCW, 2010a). The landscape may provide clues as to those areas of land that may have been more intensively used by Aboriginal people in the past due to the presence of resources such as water, stone, plants and animals and other raw materials or landscape features associated with sustenance, shelter, tool manufacture and cultural activities.

5.1 Environmental Context

5.1.1 Topography, geology and soils

The Subject Area is situated within a coastal region zone, situated in the outer Holocene dunes and located east of the Newcastle Bight sand barrier system with an extremely low local relief of less than 9 m (Matthei, 1995). The conventional coastal formation model establishes that the inner Pleistocene barrier was deposited during the last Inter Glacial period of high sea level (c. 120,000 years before present [BP]) and was later modified by erosion. After several sea level fluctuations the sea level rose (c. 18,000 BP) to form parallel sets of beach ridges in what is now the outer Holocene barrier (McCardle Cultural Heritage Pty Limited, 2015; Robson et al., 1993).

The Subject Area is located on Quaternary gravel, sand, silt, clay, and Waterloo rock, fresh and marine deposits (Newcastle Geological Sheet, 1966), lying in the outer Holocene barrier and sand dunes. These dunes are stable and have the potential to contain stratified deposits dating back to 4,500 BP (Dean-Jones, 1990).

Archaeological deposits may remain intact in subsurface areas as evidenced by a salvage excavation undertaken within 120 m of the Subject Area (McCardle Cultural Heritage Pty Limited, 2015).

The Shoal Bay soil landscape in the northern section of the Subject Area is characterised by gently inclined, well-drained Pleistocene sand sheets to rolling very low dunes. Slope gradients generally <5%, but on slopes of rolling dunes up to 15%. Local relief generally <5 m and elevation <15 m. Dunes are usually well drained. Soils are deep (>300 cm), well-drained Podzols. (OEH 2019)

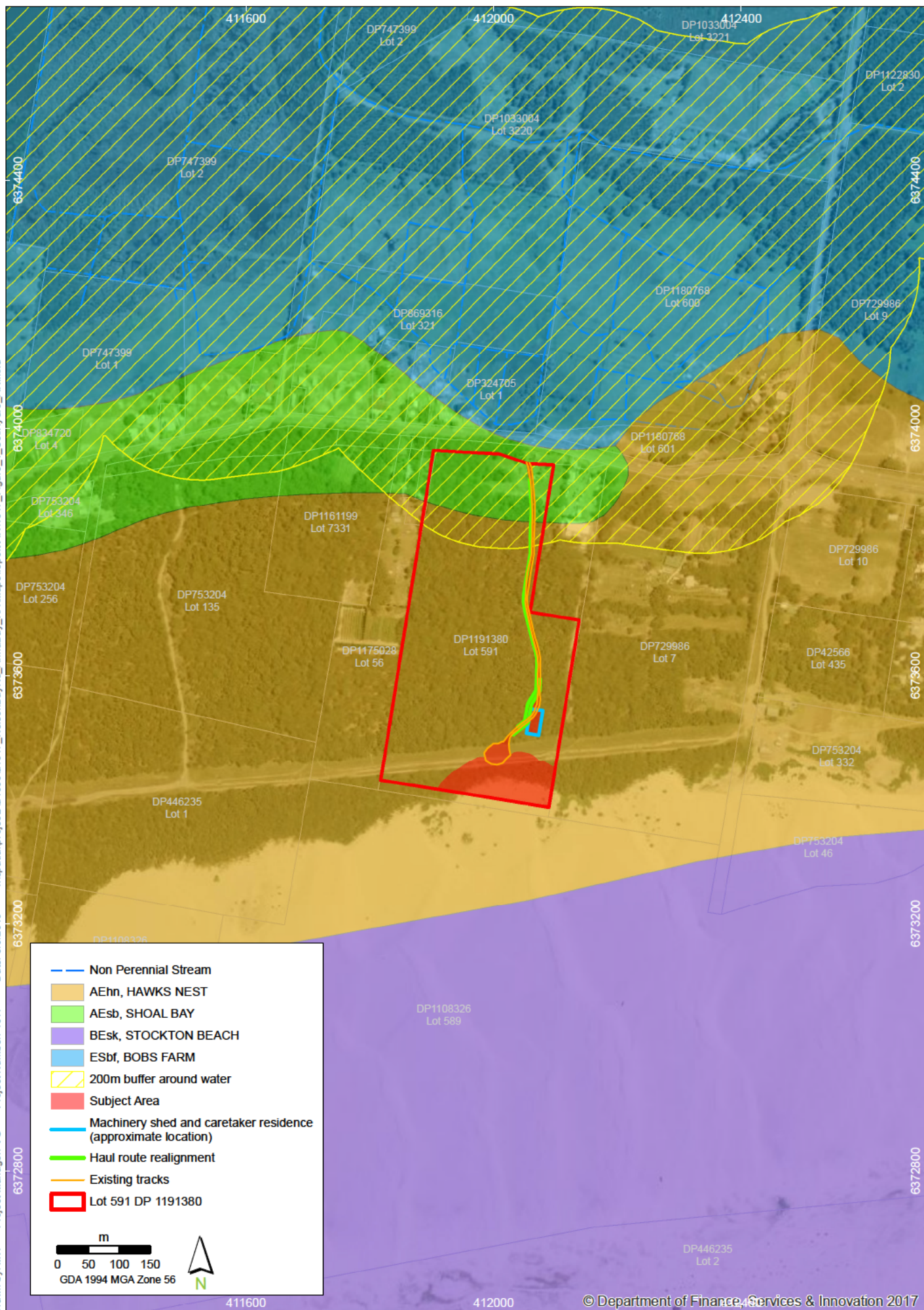
The Hawks Nest soli landscape in the southern section of the Subject Area is characterised by stable, gently undulating, Holocene sand sheets and beach ridges. Local relief <3 m, slope gradients <10%, elevation 3–12 m. Generally well drained apart from isolated low lying poorly drained swales. Vegetation typically comprises uncleared and extensively cleared dry shrubland, woodland and tall open-forest. Soils are deep (>300 cm), well-drained Podzols on dunes with deep (>300 cm) minor Acid Peats/ Siliceous Sands in swampy swales (OEH 2019)

5.1.2 Hydrology

There are no permanent fresh water sources within the Subject Area (see Figure 4). Based on climatic analysis, the investigation area will typically experience comparatively reliable rainfalls under normal conditions. The nearest permanent fresh water sources are available in the surrounding locality at Bobs Farm Creek (and swamp) (2.4 km to the northwest) and Fenninghams Island Creek (2.1 km to the northwest); however, ephemeral drainage lines, which were dry at the time of survey, were observed within the Subject Area. The southern boundary of the Subject Area is 1200 m north of the current coastline.

5.1.3 Ecology

A range of faunal populations including kangaroo, wallaby, goanna, snakes and a variety of birds is present in the Subject Area, with a wider variety of resources available in the nearby swamplands and on the beach front. The wide variety of available resources would have allowed for sustained occupation of the area. The most suitable area for Aboriginal occupation would have been the northern end of the Subject Area. This is due to its nearness to the inter barrier depression (within 60 m) that would have provided easy access to both fresh water, flora, fauna and estuary and marine resources.



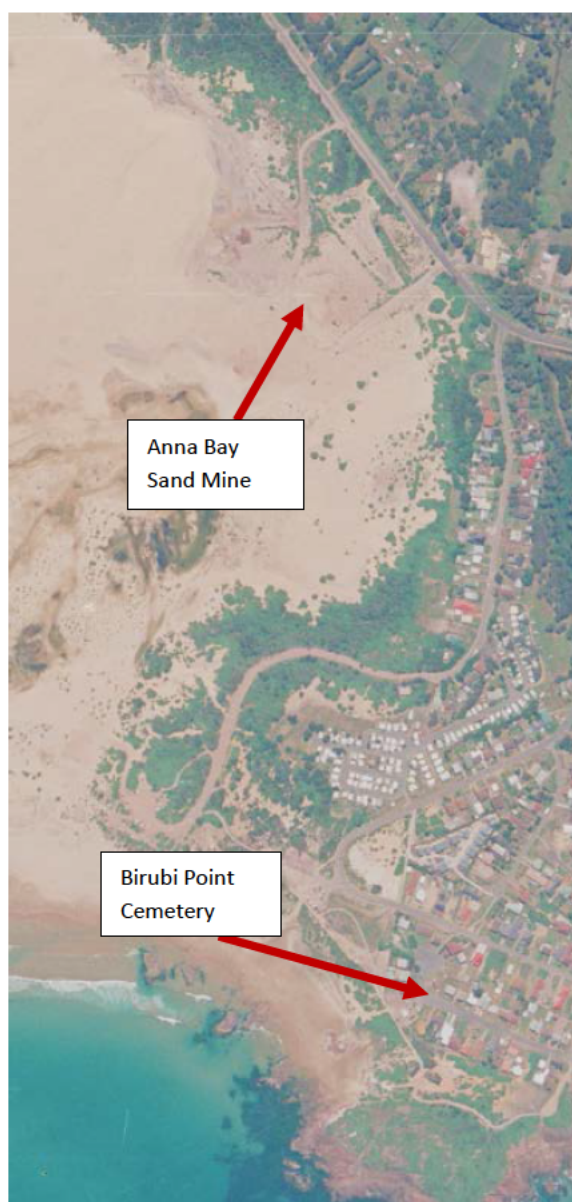
Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

5.2 Past land use and disturbance

The degree of past land use and disturbance within the Subject Area is minimal. The Subject Area has been cleared at its northern extent, with the initial street frontage to Nelson Bay Rd being resumed in 2015 in order to widen Nelson Bay Road. The original residential structure and swimming pool, which once existed in this area, has been demolished during this resumption process. Current disturbances include ancillary structures, an access road and clearing for a transmission line easement. Historical aerial photography from 1963 and 1988 confirms that the greater majority of the Subject Area was previously undisturbed natural bushland, excepting the part that has been previously developed and fronts the Nelson Bay roadway.

The following subsections present a detailed description of the historical development of the Subject Area and Anna Bay more broadly.

5.2.1 Anna Bay and surrounds



The Stockton Bight was first noted by Captain James Cook in 1770 and later mapped by Lieutenant John Shortland in 1797. The settlement of Anna Bay is located at the north-eastern end of Stockton Beach in the Hunter Region of New South Wales. It is located on the southern side of Port Stephens, which is located to the south of the one million acre land grant to the Australian Agricultural Company (AA Co) (Plate 4). William Cromarty, who was involved with the AA Co settled outside of the Company's holding at Soldier's Point to the north of Anna Bay (ABPS 2014).

The first European settlement in the area involved the establishment of dairy farms, which were constrained to the low-lying areas of Anna Bay in the 1830s (HLA 1995). An unsealed government road, which became the current Nelson Bay Road, was established to link Stockton with Nelson's Bay in the mid nineteenth century, but regular use of the road by cars did not occur until the 1920s (OEH 2015:26).

During World War II, the road between Stockton and Anna Bay was improved, with easier access encouraging more activity to occur in the area, such as holiday accommodation and residential and tourism development (OEH 2015: 26). Sand mining for heavy minerals commenced in 1968 at Anna Bay (located to the east of the Subject Area; see Plate 3), with other mines opening in Salamander, Bobs Farm, Tanilba, Oyster Cove, Williamstown and Medowie from the 1950s (Bartlett 1980).

Plate 3: 1985 aerial photo showing the sand quarry and Birubi Point Cemetery (Source LPI)

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5.2.2 Historic land use in the Subject Area

The degree of past land use and disturbance within the Subject Area is minimal. The Subject Area is located within a land grant belonging to a W. T. Blanch, who is likely John and Lucy Blanch's son William, born in 1863. The Blanch family owned much of the land within the Anna Bay area in the earliest days of European settlement, from at least the 1850s (Anna Bay Public School, 2014). It is unknown from documentary evidence what activities took place within the Subject Area, but it has remained predominately uncleared native vegetation until recent times.

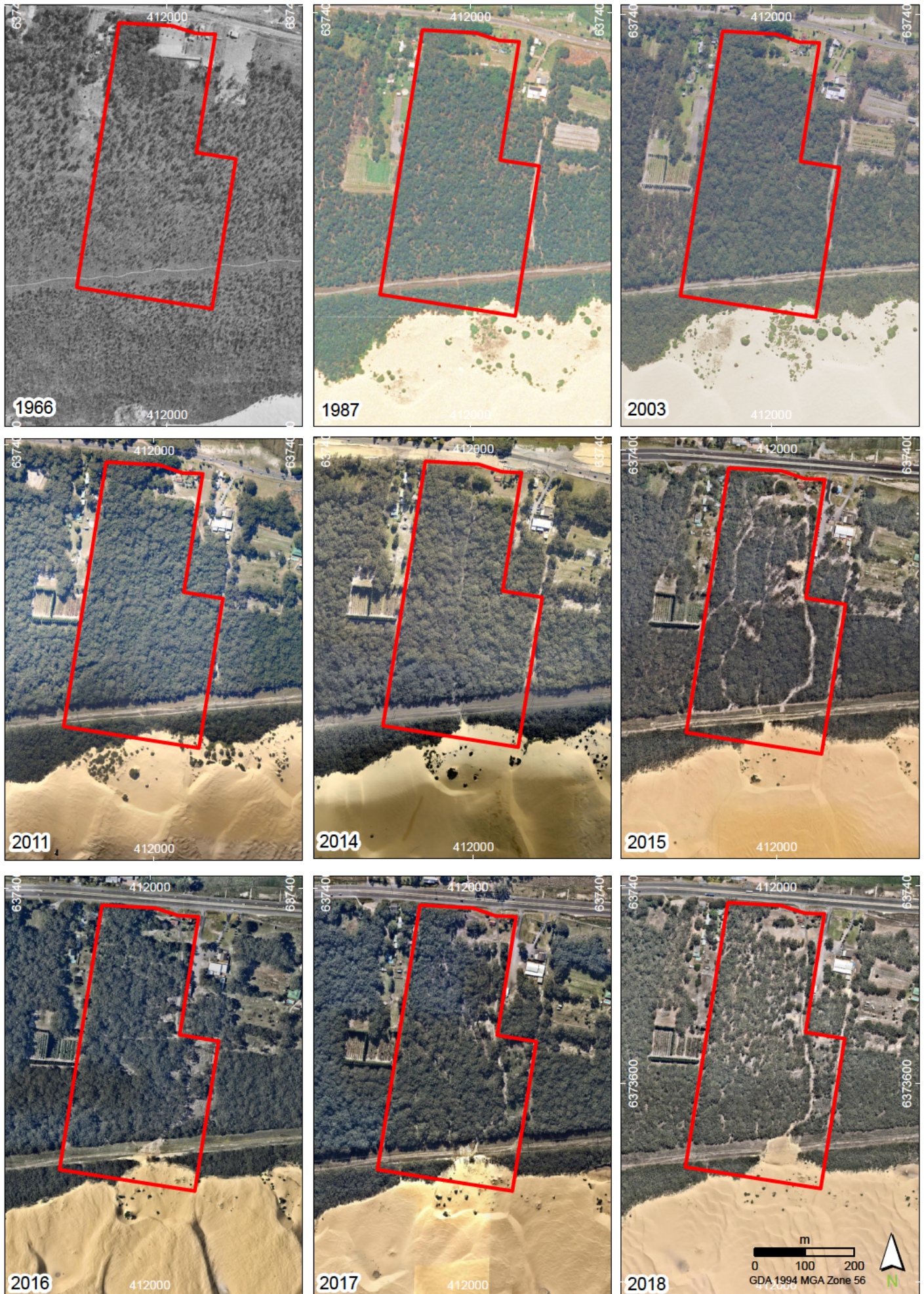
The Subject Area is also located adjacent to the second (and third) Anna Bay Public School buildings (known until 1896 as Hannah Bay Public School). The first school was gazetted in September 1879 and the proposed structure was a slab and bark hut capable of holding twenty pupils. The school was located within William Blanch's land fronting the government road on the northern side of the current Nelson Bay Road (Joe Robinson 1907 quoted in ABPS 2014:23). Construction of the first school was completed in November 1879. When this primitive structure was outgrown, a new plot of land was purchased south of the government road a new school was constructed in 1884. The school was a rounded roof structure made of corrugated iron. It had a verandah and an internal stepped floor with long bench desks which allowed the pupils and teachers to see each other more clearly. This school was demolished and replaced by a new structure in 1910 within the same plot. The newer building consisted of a 21 feet squared hipped roof building with a verandah with a flat floor. The remains of the second school were used to construct a lean-to within the school grounds (ABPS 2014). The school building is visually separated from the Subject Area by a later subdivision.

Historical aerial imagery from 1963 (see Figure 5) shows two garage buildings and a gabled roof building present fronting the road on 4226 Nelson Bay Road. At this time, directly to the west of the building group, within the Subject Area, was a cleared and cultivated field. There were long, potentially farm-related, structures running east-west across the property, extending approximately to the house and barns fronting the road. An unformed, cleared track through the native vegetation, likely relating to the transmission line, ran near the southern boundary of the Subject Area at this time; it was most likely developed following the cessation of the RAAF activities to the south of the Subject Area.

Aerial imagery shows that by 1985, the east-west farm building located to the south of the main domestic building within the Subject Area has been demolished and the majority of the cleared farm paddock to the west of the domestic building has regrown vegetation. It should also be noted that in this imagery, the sand has encroached towards the transmission line from the south, where it was not visible before. The transmission line has also been cleared and a gravel road surface added.

In imagery from 2015, Nelson Bay Road has been widened and straightened. The original residential structure and swimming pool, which once existed in this roadside area, has been demolished during the resumption process. The remaining three garage buildings are now fronting the road. The current access track exists in the 2015 imagery.

During the site inspection (see Section 10.1), it was established that the Subject Area has been cleared at its northern extent. Current disturbances include ancillary structures, an access road, and clearing for a transmission line easement. The extent of clearing and disturbance reduces the likelihood for intact Aboriginal cultural heritage site s or objects to be preserved in this area.



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

6. Regional character

The Worimi people are the traditional custodians of a large area of land known as ‘Worimi country’. Worimi Country was generally bounded by the four rivers: the Hunter River to the south, Manning River to the north, and the Allyn and Patterson rivers to the west, and included the adjoining ocean and waterways. It included 18 clan groups or ‘ngurras’, with the Subject Area falling within the area of the Maiangal ngurra. All spoke the Gathang language. (OEH 2015).

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas (McCardle Cultural Heritage, 2015:14). The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The Stockton Beach Dune System is the largest mobile dune in coastal Australia and represents an important area of cultural heritage (OEH, 2004).

The area was rich in resources, with direct access to marine (both ocean and estuarine), forest and stone resources from the neighbouring headlands. The history of the Worimi people and the connection with the area is abundantly evident in the extent and diversity of the cultural material present throughout the adjoining areas. The flora and fauna of the region provide traditional foods and medicines and raw materials for a variety of traditional tools and implements. At least 50 plant species are known to be significant in terms of their cultural use associated with traditional tools and implements, food or medicine (Bell & Driscoll 2010).

In April 1770, James Cook sighted the Port and named it in honour of Sir Phillip Stephens, Secretary to the Admiralty, noting in his log book that it appeared “to be sheltered from all winds” and that “there might be a sufficient depth for shipping water in the bay” (NSW Education, unknown:1).

Port Stephens was not entered by Europeans until late 1871 when the ‘Salamander’, docked, transporting convicts to Sydney. It appears that the earliest Europeans to live in the area were five escaped convicts, wrecked at Port Stephens in 1790 (McCardle Cultural Heritage 2015:18). The Worimi, were extremely accommodating taking them into their tribe (McCardle Cultural Heritage 2015:19). Five years later they were ‘rescued’ by Captain W.R. with the Reliance and Supply.

In 1797, Lieutenant John Shortland sailed the narrow inlet around 30km to the south of Port Stephens, finding coal. The settlement of Newcastle soon followed, on Port hunter, initially a convict settlement. By 1822 the town was prospered as free settlement and became the gateway to the Hunter Valley (NSW Education, unknown: 2).

In 1830 a historical account by Robert Dawson described the Worimi Tribe as “utilising spears and shields, wearing belts of opossum fur and using combs formed from the leg bones of kangaroos” (Dawson, 1830:115 in McCardle Cultural Heritage, 2015:17).

Much of the land has changed drastically since 1788, and dispossession has had significant impacts on Worimi people and their culture.

Nevertheless, the land and waters have been used for thousands of years for the hunting and gathering of foods, fishing and the continuation of cultural, spiritual and sacred activities. Aboriginal cultural connections have always been strong in this area and continue today, as it is still a well-utilised fishing and recreational area used by today's Worimi people (MCH 2015).

The Worimi Country can be mapped archaeologically and with traditional knowledge of areas/sites including sacred sites, meeting places, burial ground(s), and travel routes of a large society. There has been a considerable amount of archaeological investigation and reporting throughout the area, with large numbers of Aboriginal cultural heritage sites identified. Dean-Jones (1990, 1992) and Umwelt (2000) have done extensive work in the Worimi Conservation Land. Investigations of a smaller section of the area were Comber (1990) and ERM (1995, 2001). Additionally, Umwelt (1997), Hall (1928), MCH (2004, 2005) and Dyll (2004) have conducted archaeological investigations at Birubi Point.¹

Following the initial period of dune formation and mobility between 6,000 and 4,500 years ago, there have been periods in time when the dunes have been stable. During these periods of prolonged stability, the dunes were vegetated. After each period of stability, mobile dunes developed and buried the vegetated dunes.

Shell middens are quite extensive in the area, with shell deposits consisting predominately of pipi (*Plebidonax deltoids*) shell. Some also contain mud whelk (*Pyrazus ebininus*) and cockle (*Anadara trapezia*) shells; stone artefacts, bird, fish and animal bones (McCardle Cultural Heritage, 2015:17). Additionally, burial sites are recorded within the Worimi Conservation Land and are difficult to predict within the landscape.

6.1 Synthesis of regional character and Aboriginal land use

The Subject Area is located in the Coastal Zone of the Hunter Valley, in particular, it is situated within the outer Holocene barrier and sand dunes. The resources in this area would have been well utilised by Aboriginal people in the past, but modifications including residential developments are likely to have disturbed areas containing archaeological materials. The Outer Holocene Barrier contains stable dunes and the potential to contain stratified deposits dating back to 4,500PB (Dean-Jones, 1990).

The Stockton Bight is a unique coastal embayment and a well preserved example of a dual barrier system close to the major metropolitan centres of Newcastle and Sydney (Australian Heritage Database). The Newcastle Bight has some of the largest midden sites in NSW as well as burial and educational sites (Australian Heritage Database). The barrier dune system of the Stockton Bight is 31 km long and ranges from one to two kilometres in width.

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas (McCardle Cultural Heritage Pty Limited, 2015). The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The

¹ References were taken from McCardle Cultural Heritage, 2015:17)

Stockton Beach Dune System is the largest mobile dune in coastal Australia and represents an important area of cultural heritage (OEH, 2004).

The area was rich in resources, with direct access to marine (both ocean and estuarine), forest and stone resources from the neighbouring headlands. The history of the Worimi people and the connection with the area is abundantly evident in the extent and diversity of the cultural material present throughout the adjoining areas. For example, spears used for fishing were made from the flowering stem of the Grass Tree or Gynea Lily, with prongs of ironbark used on the tips.

Port Stephens was not entered by Europeans until late 1871 when the ‘Salamander’, docked, transporting convicts to Sydney. It appears that the earliest Europeans to live in the area were five escaped convicts, wrecked at Port Stephens in 1790 (McCardle Cultural Heritage Pty Limited, 2015). The Worimi were extremely accommodating, taking them into their tribe (McCardle Cultural Heritage Pty Limited, 2015). Five years later they were ‘rescued’ by Captain W.R. Broughton with the Reliance and Supply.

The Worimi people maintain a strong relationship with their traditional lands. Despite the social and cultural dislocation that would have occurred post-European settlement of the area, many Aboriginal people continue to live within the Port Stephens region and its surrounds, and continue to care for country and make decisions on the management and maintenance of cultural heritage sites and matters.

“The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to our ancestors and storylines”. (Anthony Anderson, Mur-Roo-Ma Incorporated).

7. Predictive model

Predictive modelling has been developed for the area utilising data from the archaeological, geological and geomorphic research presented in the ACHAR. Previous archaeological studies undertaken throughout the area provide a good indication of Aboriginal cultural heritage site types and Aboriginal cultural heritage site patterning in the area. These studies have shown that shell middens associated with stone artefacts and middens with only shell fragments are the most predominate Aboriginal cultural heritage site types within the area. The most common Aboriginal cultural heritage site location is the seaward area of active transgressive dunes/ active blowout. This is then followed by the beach fore dune and outer basin (Eric Martin and Associates, 2002:34). The Subject Area lies in the Outer Holocene barrier and sand dunes.

The general predictions and key trends are listed below:

- The most common Aboriginal cultural heritage site types are open Aboriginal cultural heritage site s containing shell with artefacts, followed by isolated finds.
- Aboriginal cultural heritage site s are usually located within 50 metres of reliable water source.
- Aboriginal cultural heritage site s are located both on the Holocene and Pleistocene dunes overlooking the interbarrier depression.
- Aboriginal cultural heritage site s are not usually found in the interbarrier depression.
- Aboriginal cultural heritage site types are predominately shell middens, stone tools and may also contain charcoal.
- Artefact scatters, isolated finds, scarred trees, burials and ceremonial sites may also be found along the dunes.
- Larger Aboriginal cultural heritage site s with higher densities of artefacts are more likely to be found close to stream confluences and permanent water sources, such as Tillegerry Creek (approximately two kilometres from the Subject Area).
- Artefacts typically date to the Holocene.
- Both middens (including estuarine shell species, rock oysters and mud whelk) and open camp sites are located on the inner landward margin of the Holocene dunes.
- Stone artefact types include flakes, flaked pieces, broken flakes, cores and tools.
- ***Artefact scatters are most commonly linked in close proximity to permanent water sources including creeks, swamps, the inter barrier depression and the coast.***
- ***Frequency and density of artefacts are directly related to location within the landscape.***
- ***Large Aboriginal cultural heritage site s increase markedly with proximity to permanent water sources.***
- ***The majority of Aboriginal cultural heritage site s will be subject to disturbances including human and natural.***
- ***High concentrations of artefacts are more likely to be located within resource rich areas.***

A site specific predictive model was developed and is described below. This predictive model has been developed based on a review of landscape context and individual landforms, ethno historical evidence of traditional land use, distribution of natural resources, the results of previous archaeological work in the vicinity of the study area and the predictive modelling proposed in previous investigations.

- Shell artefacts and stone artefacts will be the most common Aboriginal cultural heritage site type across the landscape and are the most likely Aboriginal cultural heritage site type to occur within the Subject Area.
- The unconsolidated sand at the top of the dune within the Subject Area is predicted to have lower archaeological integrity owing to the mobility of the dunes, than the stable sediment at the base of the dune, which has a higher likelihood of containing in situ archaeological deposits.
- Aboriginal cultural heritage sites will most commonly be low density artefact scatters or isolated finds, although high density scatters may also be present.
- Relatively undisturbed soils have potential to contain subsurface archaeological deposits.
- Excavations within the region suggest that high densities of artefacts are present around 50 m from water sources, and that subsurface material may be much greater than indicated by surface numbers of artefacts. Densities of artefacts are likely to be lower within the Subject Area due to its distance from water sources.
- Given the environmental context of the sand dunes, and the proximity to Birubi Aboriginal Burial Ground, it is possible that burials may occur in the sand dunes though such an occurrence would be rare. Burial sites can occur anywhere but generally in significant landform locations and generally in soft soils.
- The following Aboriginal cultural heritage site types are **unlikely** to occur in the Subject Area:
 - Stone quarry sites, axe grinding grooves, stone engravings/art and shelter sites due to the lack of suitable geology.
 - Scarred or carved trees due to the extent of vegetation clearing in the region.

8. Sampling Strategy

8.1 Archaeological survey

The aim of the survey was to inspect the impact footprint of the Subject Area to identify and ground-truth any Aboriginal cultural heritage site s that were already registered, and to identify Aboriginal cultural heritage site s that may be present within the Subject Area. It also aimed to provide further information on the Aboriginal cultural heritage values of the Subject Area. The field survey covered the entire Subject Area with an additional buffer around the entire extent of the proposed impact footprint including the manager's residence/site office as well as the sand quarry. All data was recorded in accordance with the Code of Practice.

8.2 Archaeological test excavation

The purpose of this section is to describe the method that was used to conduct archaeological test excavation of the area identified as having potential for archaeological deposits (PAD), Anna Bay PAD-1 (AHIMS ID#38-5-0347), and would be impacted by the proposed sand extraction. The aim of the test excavation was to provide further information on the presence, nature, significance and extent of sub-surface archaeological deposit within the Subject Area, and the Aboriginal archaeological values of the Subject Area.

The environmental context of the PAD, being an unconsolidated sand dune, means that test excavation methodology suitable for the unstable landform does not follow the conditions and methodology set out in the Code of Practice. As such, it was proposed to implement alternate excavation methods, as outlined in the test excavation methodology. Owing to these factors, an AHIP was sought from the OEH to complete an archaeological testing program to test the area identified as Anna Bay PAD-1 (AHIMS ID#38-5-0347). The AHIP (C0004974) was issued on 8 July 2019 (see Annex D).

The test excavations targeted Anna Bay PAD 1, as it would be directly impacted by the proposed development, and has been assessed as having the potential to contain Aboriginal artefacts. The proposed quarry would remove all of the sand within the PAD to ground level, destroying any in situ Aboriginal cultural heritage site s. The remainder of the Subject Area will either not be impacted during the proposed project, or has been disturbed to an extent where the likelihood of Aboriginal artefacts existing is significantly lower than the Anna Bay PAD 1.

10–20 non-stratigraphic shovel test pits were planned to be excavated along the top of the sand dune, within the impact footprint and AHIP area. The purpose of these trenches would be to:

- identify the presence or absence of Aboriginal objects within the highly dynamic area of the sand dune; and
- collect soil samples for pH test, and munsell colour determination.

Additionally, 10–20 stratigraphic trenches measuring 50 cm x 50 cm were planned to be excavated by hand at the base of the dune, within the AHIP area. The purpose of the test pits was to:

- Establish the stratigraphy of potential subsurface deposits.
- Identify the presence or absence of Aboriginal objects.
- Collect radiocarbon dating samples, if present.
- Collect soil samples.
- Assist in the identification of archaeologically sterile unit should that occur within the impact footprint.

It was anticipated that a maximum of 20 m² would be excavated during the test excavations. This is less than 0.3% of the total area of Anna Bay PAD 1, being 6793 m². Expansion test pits, triggered by the criteria in Section 4.4.3 would be limited to an additional 40 m².

A methodology for the test excavation was developed in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010* and provided to the RAPs as part of the Stage 2 and 3 consultation process, documented in Section 3 of the Aboriginal Cultural Heritage Assessment Report.

9. Assessment and field methods

The following methods were used to identify archaeological resources, heritage values and significant cultural themes for the Subject Area:

- Aboriginal community input – this was sought throughout the project via the consultation process, participation in archaeological fieldwork and other correspondence (see Section 3 of the ACHA).
- Archaeological research, including landscape characterisation, analysing previous archaeological works in the region and field survey (Attachment 2, Section 4, Section 5, Section 6, Section 7).
- Archaeological test excavation (Section 10).

9.1 Archaeological survey

The visual inspection of the Subject Area was undertaken on 11 October 2018 by Balazs Hansel (Senior Heritage Consultant; Niche) and a groups of six RAPs representatives (Table 5) The field survey covered the entire Subject Area with an additional buffer on around the entire extent of the proposed impact footprint including the haul road, machinery shed and caretaker residence and sand mine.

The survey methodology is outlined below:

- A hand held GPS unit was used to record all tracks and appropriate Aboriginal cultural heritage site data for the survey.
- Representative photographs were taken of survey units, different visibility levels, exposures and disturbed areas.
- Different types and level of exposure was recorded, defined as an estimate of the area which has a likelihood of revealing buried artefacts or deposits. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground, i.e. visibility refers to what reveals (Burke and Smith 2004:78-80).
- Archaeological visibility was recorded, defined as the amount of bare ground on the exposures which might reveal artefacts or other archaeological materials, i.e. visibility refers to what conceals (Burke and Smith 2004:78-80).
- Effective survey coverage area was also recorded (the area of the survey unit multiplied by the visibility percentage and exposure percentage).

9.2 Archaeological test excavation

The archaeological test excavation of the Subject Area determined whether Aboriginal objects and archaeological potential exist within the Subject Area and was conducted in accordance with conditions set out in AHIP C0004974.

The methodology for the test excavation was agreed by the RAPs during Stage 2 of the consultation process, and a copy of it is included in Appendix B of the ACHAR.

The test excavations was carried out from 23 to 25 July 2019, and focused on areas of potential sensitivity that would be impacted by the proposed works.

It was predicted that it would be too difficult to test the sand body within Anna Bay PAD 1 using traditional methods without a significant safety risk due to the very loose nature of the sand. Owing to this, it was proposed to use two different methods of excavation within the PAD.

On top of the sand dune, where the sand is extremely loose and soft, test excavations were:

- Carried out using a shovel to dig test pits measuring approximately 50 cm x 50 cm over two 5 m x 5 m grids. Figure 7 depicts the positioning of the test pits.
- Test Pits were hand excavated.
- Excavation ceased:
 - Where it was considered that digging any deeper would be unsafe without the aid of benching or shoring; or
 - where sufficient information was recovered to understand the extent, nature and significance of the archaeological deposit, if any.
- All excavated material was dry sieved through 3 mm mesh screens. These test pits were not dug in controlled spits, owing to the unconsolidated nature of the sediment profile.
- Photographic recording of each hole was taken, as well as GPS locations.

The test excavation methodology for the stable ground surface at the base of the sand dune is outlined below:

- Test excavation pits measured 50 cm x 50 cm and were laid out over two 10 m x 10 m grids. Figure 7 depicts the positioning of the test pits.
- The excavation pits were hand excavated.
- Excavation was carried out using 5 cm spits for the first spit, and 10 cm spits for each test pit thereafter to:
 - the base of artefact bearing layers;
 - a viable B horizon indicating a base of artefact layer;
 - where it would be considered that digging any deeper would be unsafe; or
 - where sufficient information has been recovered to understand the extent, nature and significance of the archaeological deposits
- Should it have been necessary, test excavation pits would have been expanded using 50 cm x 50 cm pits to document archaeological features or areas of relatively high artefact density. These areas would not exceed 3 m² in surface area.
- All excavated material was weighed prior to sieving to allow for the provision of proportional weights for analysis of shell or faunal bone if it was identified within the PAD.
- All excavated material was dry sieved through 3 mm mesh.
- Soil was retained for backfilling of test pits.
- All excavation units (spits, contexts, stratigraphic units etc.) were assigned a unique identifier.
- If specific archaeological features such as hearths were identified the feature would have been excavated stratigraphically and been photographed and drawn.
- Photographic recording of each pit and spit as well as large scale photos of transects were taken.

- Scaled drawings of one section of each test pit were completed.
- Non-differential GPS readings were taken at each test pit location.

Altogether 10 test pits were dug on the top of the dune, and six were dug at the base of the dune. None of the test pits were expanded as they did not:

- contain cultural layers;
- high numbers of artefacts;
- archaeological features; or
- dateable material.

9.3 Artefact analysis and cataloguing

No artefacts were identified during the test excavations.

9.4 Shell attribute recording and analysis

No shell material was identified during the test excavations.

9.5 Faunal remains attribute recording and analysis

No faunal material was identified during the test excavations.

9.6 Sensitive cultural information- Management protocol

During the consultation process the proponent and Niche provided the opportunity for the RAPs to provide cultural information, including a statement of the value of identified Aboriginal cultural heritage sites and other matters. The input points were listed within the excavation methodology that has been included in Attachment 2 of the ACHAR, information would have been accepted at any point during the project prior to the finalisation of the Aboriginal Cultural Heritage Assessment and Archaeological Report.

RAPs were made aware that the proponent or Niche staff would seek cultural information and supporting evidence in regard to matters of cultural value.

In the event that a stakeholder had sensitive or restricted public access information it was proposed that the proponent and Niche would manage this information (if provided by the Aboriginal community) in accordance with a sensitive cultural information management protocol. It was anticipated that the protocol would include making note of and managing the material in accordance with the following key limitations as advised by Aboriginal people at the time of the information being provided:

- any restrictions on access to the material
- any restrictions on communication of the material (confidentiality)
- any restrictions on the location/storage of the material
- any cultural recommendations on handling the material
- any names and contact details of persons authorised within the relevant Aboriginal stakeholder to make decisions concerning the Aboriginal material and the degree of authorisation.

- any details of any consent given in accordance with customary law
- any access and use by the registered Aboriginal stakeholders of the cultural information in the material.

No sensitive material was provided by the RAPs to the proponent or Niche to be included within the ACHA assessment or report.

10. Results

10.1 Archaeological survey

The archaeological survey of the Subject Area was carried out on the 11 October 2018. Details of the participants are provided in Table 5 below.

Table 5: Details of field survey participants

Name	Organisation
Balazs Hansel	Niche
Bec Young	Mur-roo-ma Incorporated
Candy Towers	Worimi Traditional Owners Indigenous Corporation
Dave Feeney	Karuah Indigenous Corporation
Jamie Merrick	Worimi Local Aboriginal Land Council
Laurie Anderson	Nur-Run-Gee Pty Ltd
Tamara Towers	Worimi Traditional Owners Indigenous Corporation

The field survey covered the entire Subject Area with an additional 10 m buffer around the entire extent of the proposed impact footprint including the haul road, machinery shed, caretaker residence and sand mine.

A summary of survey coverage and landform coverage is provided in Figure 6.

Ground surface visibility was low to moderate across the subject area with 50% exposure, mostly along the already existing haul road and around the sand dune and powerline easement. Exposure was significantly lower on both sides of the haul road and the proposed location of the machinery shed and caretaker residence. Effective survey coverage was 20%.

The already recorded Aboriginal cultural heritage site 'NBRd 4 AHIMS ID#38-5-0320' was relocated in the northern part of the property. The Aboriginal cultural heritage site will not be impacted by the proposed haul road, as the section in close vicinity of the Aboriginal cultural heritage site has been already built and there are no modifications proposed.

No additional Aboriginal cultural heritage sites were identified, however the survey identified areas of archaeological potential within the following areas:

- Anna Bay PAD 1 (AHIMS ID 38-5-0347): The immediate vicinity and foreground of the sand dunes in the southern section of the property.

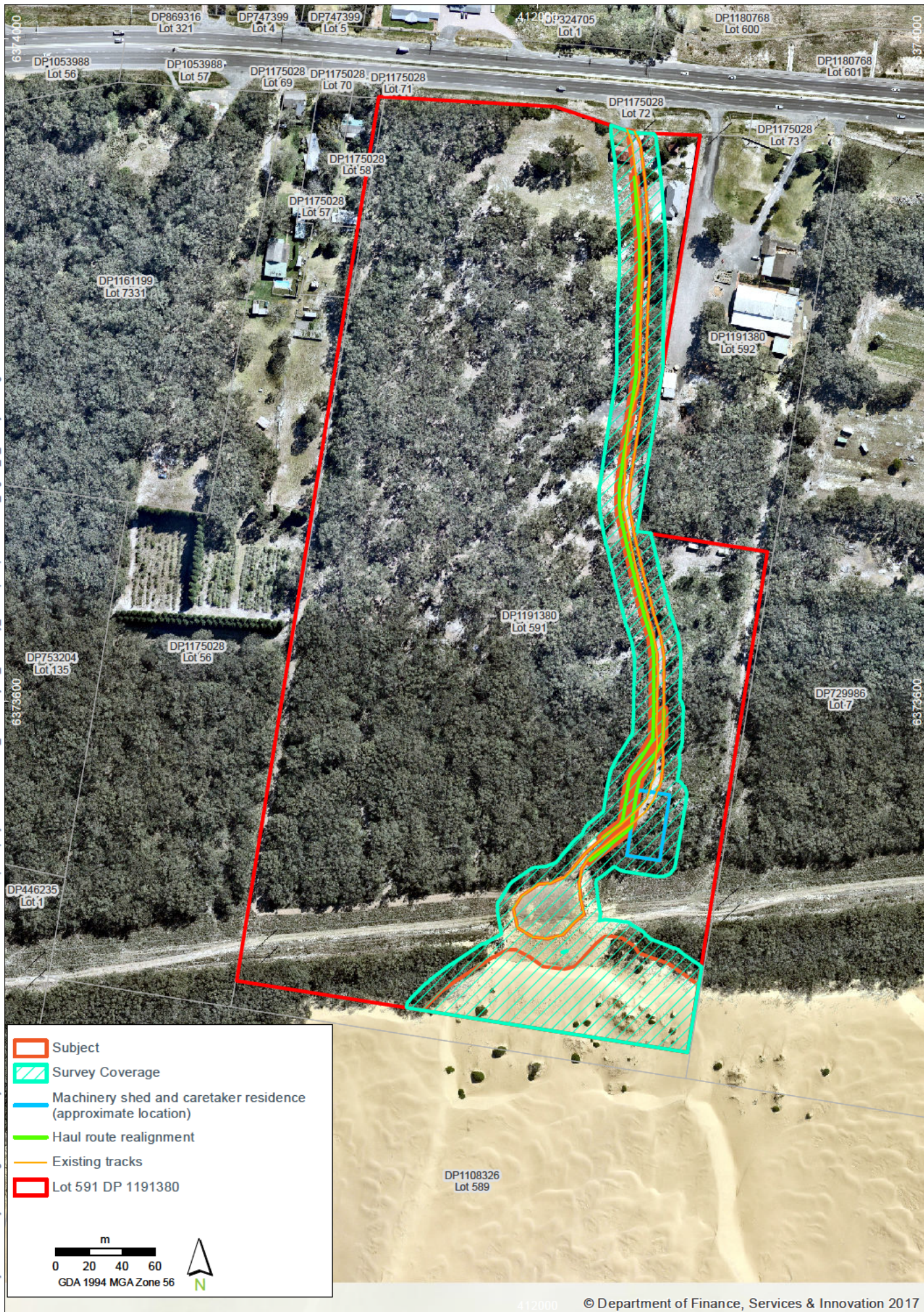
The survey recommended further investigation in the form of test excavation to increase archaeological exposure and visibility and to test the potential of the landform for archaeological resources.

Table 6: Surface survey coverage

Landform	Survey Unit (m ²)	Visibility %	Exposure %	Effective Survey coverage area (m ²)	Effective coverage %
Outer dunes	25905	40%	50%	5181	20

Table 7: Landform summary

Landform	Landform area (m ²)	Area effectively surveyed (m ²)	% of landform effectively surveyed	Number of Aboriginal cultural heritage sites	Number of artefacts or features
Outer dunes	25905	5181	20	2	1



10.2 Test excavation results

No Aboriginal objects were identified during the test excavation. A summary of test pits, depths and finds is provided in Table 8. The locations of the test pits within the Subject Area are depicted in Figure 7.

Table 8: Summary of excavation results

Test Pit ID	Depth excavated	Excavation ceased at	Aboriginal objects summary
Top of Dune			
DT-TP-01	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-02	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-03	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-04	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-05	0-500 mm	Unstable depth in A2 horizon	None
DT-TP-06	0-600 mm	Unstable depth in A2 horizon	None
DT-TP-07	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-08	0-650 mm	Unstable depth in A2 horizon	None
DT-TP-09	0-550 mm	Unstable depth in A2 horizon	None
DT-TP-10	0-650 mm	Unstable depth in A2 horizon	None
Base of Dune			
DB-TP-01	0-350 mm	B1 Horizon	None
DB-TP-02	0-350 mm	B1 Horizon	None
DB-TP-03	0-1150 mm	B2 Horizon	None
DB-TP-04	0-550 mm	B2 Horizon	None
DB-TP-05	0-550 mm	B2 Horizon	None
DB-TP-06	0-750 mm	B2 Horizon	None

10.2.1 Soil profiles

The soil profile of Anna Bay PAD 1 is that of a sand dune with loose surface conditions and a rapidly draining profile. Soil horizon A1 consists of a dry, coarse-grained, sand with charcoal or gravel fragments. Soil horizon A2 consists of a moist, coarse sand with no charcoal or gravel fragments evident. Both A-horizon sediments were well sorted. Soil horizon B1 contains a finely grained, well sorted, very dark grey sand with high levels of decomposing organic material. Soil horizon B2 consists of grey coarse-grained sand with few inclusions; this sand is noticeably less compacted than horizon B1. See Annex B for detailed test pit data

10.2.1.1 Top of Dune

The A Horizon was present in all pits and comprised a clean loose sand that became damper and more compacted with increasing depth as it transitioned from A1 to A2. The test pits at the top of the dune all contained sand with minimal inclusions. On top of the dune, excavation ceased at approximately 600–650 mm deep when the pits became too unstable to continue digging safely.

10.2.1.2 Base of Dune

Spit 1 from the test pits at the base of the dune contained A1 horizon sand with small pieces of introduced material such as broken glass, ceramics, gravel and fill material. This transitioned to A2 at approximately 15cm below the surface. Small amounts of decomposing organic material started to appear in the test pits at approximately 200 – 300mm below the surface (a2 transitioning to B1). The sand then transitioned to a finer very dark grey sand with increasing amounts of decomposing organic material between 200 – 400 mm below the surface. This layer became increasingly darker with higher organic content and compaction with depth. It then gave way to a loose, coarse grained, grey sand (B Horizon) with no organic material at depths between 500 and 800 mm below the surface. At the base of the dune, excavation ceased in the B Horizon.

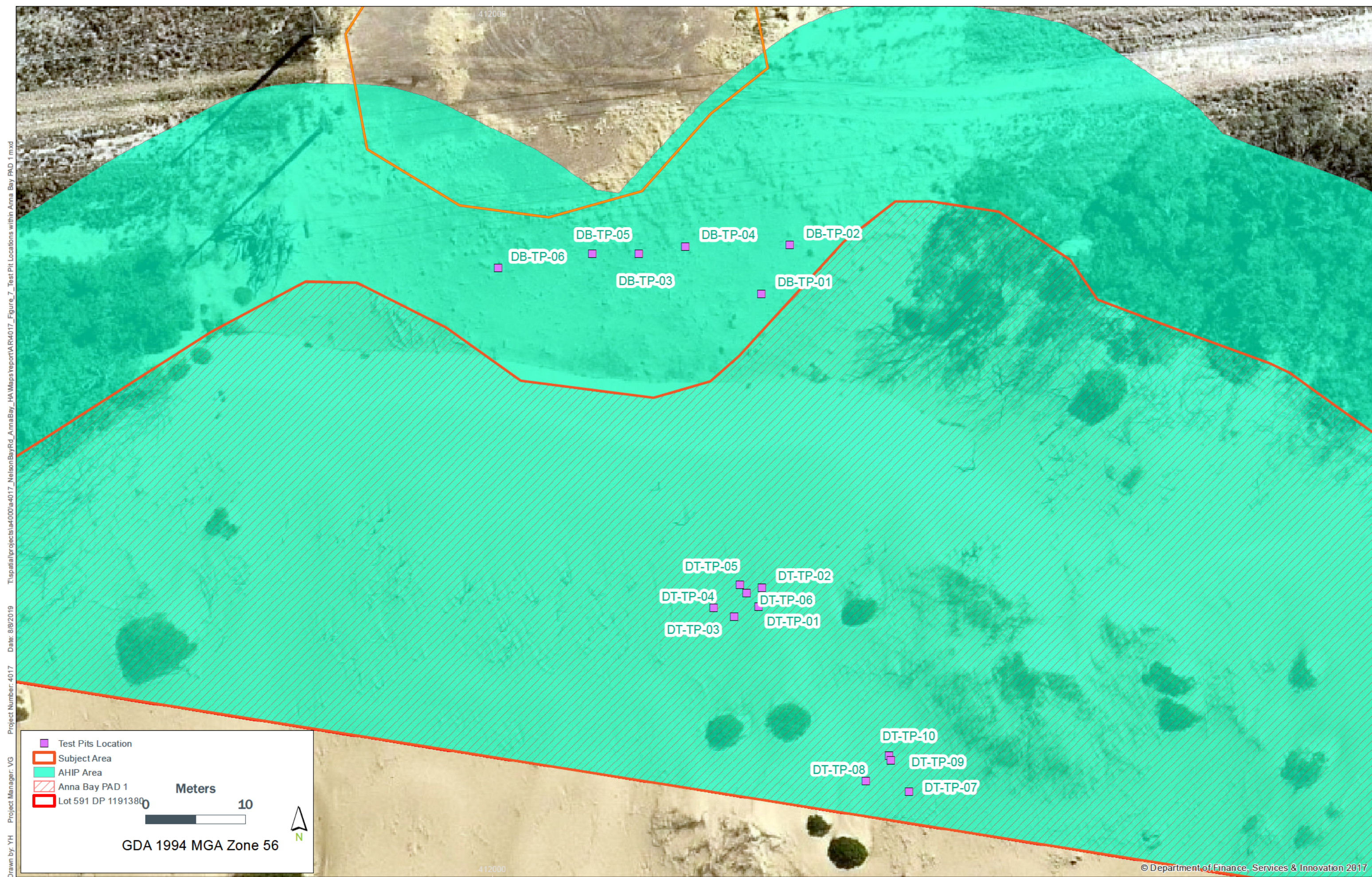


Plate 5: Typical section of a test pit at the top of the dune (DT-TP-06)



Plate 6: Typical section of a test pit at the base of the dune (DB-TP-04).

Drawn by: YH Project Manager: VG Project Number: 4017 Date: 8/8/2019 T:\spatial\projects\4000\4017_NelsonBayRd_AnnBay_HA Maps\report\AR4017_Figure_7_Test Pit Locations within Anna Bay PAD 1.mxd



Suburb : Anna Bay, LGA: Port Stephens Council, Parish: Tom area



Test Pit Locations with in Anna Bay PAD 1
4226 Nelson Bay Rd, Anna Bay, SandQuarry – Archaeological Report

FIGURE 7
Imagery: (c) Nearmap 2018-09-09

11. Analysis and discussion

One Aboriginal cultural heritage site (NBRd 4 AHIMS ID#38-5-0320) was relocated, and an area of high archaeological sensitivity, Anna Bay PAD 1 (AHIMS ID 38-5-0347) was identified during the field survey.

Aboriginal cultural heritage site NBRd 4 AHIMS ID#38-5-0320 will not be harmed by the development.

The archaeological test excavation of Anna Bay PAD 1 did not identify any Aboriginal objects. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site. An Aboriginal Site Impact Recording Form was submitted to BCD advising of the updated status “Not a Site” (Annex E)

During the test excavation, discussions with the owner of the neighbouring property informed the field team that the previous owner of the Subject Area had cleared all of the vegetation that grew along the dunes in Anna Bay PAD 1 approximately 3 years ago. The previous owner also brought in introduced material including roadbase and gravel to construct tracks. The proponent advised that the removal of the vegetation allowed the dunes to move northward to such an extent that emergency extraction of sand was required to be carried out approximately 1 year ago to remove sand from a dangerous height beneath the transmission lines. The loose nature of the aeolian sand on the dunes, and the presence of foreign material at the base of the dunes support these accounts.

The RAPs discussed that during the construction of Nelson Bay Road, the vegetation was mulched and deposited in the Subject Area. They suggested that this could be what is evidenced by the layer of sediment containing decomposing organic material that was identified during the test excavation.

Based on the above, it can be deduced that no known Aboriginal objects or deposits likely to contain Aboriginal objects will be harmed by the development.

12. Scientific values and significance assessment

12.1 Assessment framework

The Burra Charter (Australia ICOMOS 2013) defines the basic principles and procedures to be observed in the conservation of important places. It provides the primary framework within which decisions about the management of heritage sites in Australia should be made.

The NSW Aboriginal cultural heritage regulatory framework supports the significance assessment of Aboriginal archaeological sites and provides guidelines for this ACHA within the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011). The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) outlines two main themes in the overall Aboriginal cultural heritage significance assessment process, namely, the identification of the cultural/social significance of Aboriginal objects and/or places to Aboriginal people and the identification of the scientific (archaeological) significance to the scientific/research community. These themes encapsulate those aspects of the Burra Charter that are of particular relevance to Aboriginal objects and places.

12.1.1 Cultural significance

The Burra Charter defines cultural significance as being derived from the following values: aesthetic value, historic value, scientific value and social value however, more precise categories may be developed as an understanding of a particular place or site increases.

Table 9: Values from which cultural significance is derived

Value type	Description
Aesthetic Value	Aesthetic value includes aspects of sensory perception for which criteria can and should be stated. Such criteria may include consideration of the form, scale, colour, texture and material of the fabric; the smells and sounds associated with the place and its use.
Historic Value	Historic value encompasses the history of aesthetics, science and society, and therefore to a large extent underlies all of the terms set out in this section. A place may have historic value because it has influenced, or has been influenced by, an historic figure, event, phase or activity. It may also have historic value as the site of an important event. For any given place the significance will be greater where evidence of the association or event survives in situ, or where the setting are substantially intact, than where it has been changed or evidence does not survive. However, some events or association may be so important that the place retains significance regardless of subsequent treatment
Scientific Value	The scientific or research value of a place will depend upon the importance of the data involved, on its rarity, quality or representativeness (conservation value), and on the degree to which the place may contribute further substantial information.
Social Value	Social or cultural value refers to the spiritual, traditional, historical or contemporary associations and attachments the place or area has for Aboriginal people. Social or

Value type	Description
	cultural value is how people express their connection with a place and the meaning that place has for them. Places of social or cultural value have associations with contemporary community identity. These places can have associations with tragic or warmly remembered experiences, periods or events. Communities and individuals can experience a sense of loss should a place of social or cultural value be damaged or destroyed.

12.1.2 Scientific significance

The Guidelines specify that information about scientific values will be gathered through archaeological investigation carried out according to the Code of Practice. The Code of Practice itself does not specify criteria for assessment of Aboriginal objects, but rather suggests to “identify the archaeological values and assess their significance.” The assessment must be supportable and the assessment criteria must reflect best practice assessment processes as set out in the Burra Charter. The scientific values described in the Burra Charter were considered further by the then NSW National Parks and Wildlife Service in their *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC 1997). In lieu of specific criteria, the advice from the *Aboriginal Cultural Heritage Standards and Guidelines Kit* (DEC 1997) is summarised and paraphrased below to provide guidance to the assessment of scientific values.

Table 10: Criteria for assessing scientific value

Scientific value	Description
Research potential	It is the potential to elucidate past behaviour which gives significance under this criterion rather than the potential to yield collections of artefacts. Matters considered under this criterion include the intactness of a site, the potential for the site to build a chronology and the connectedness of the site to other sites in the archaeological landscape.
Representativeness	As a criterion, representativeness is only meaningful in relation to a conservation objective. Presumably all sites are representative of those in their class or they would not be in that class. What is at issue is the extent to which a class of sites is conserved and whether the particular site being assessed should be conserved in order to ensure that we retain a representative sample of the archaeological record as a whole. The conservation objective which underwrites the ‘representativeness’ criteria is that such a sample should be conserved.
Rarity	This criterion cannot easily be separated from that of representativeness. If a site is ‘distinctive’ then by definition, it will be part of the variability which a representative sample would represent. The criteria might best be approached as one which exists within the criteria of representativeness, giving a particular weighting to certain classes of site. The main requirement for being able to assess rarity is to determine what is common and what is unusual in the archaeological record, but also the way that archaeology confers prestige on certain sites because of their ability to provide certain information. Items may be common, uncommon or rare. The criterion of rarity may be assessed at a range of levels including local, regional, state, national, and global.
Educational potential	This criterion relates to the ability of the cultural heritage item or place to inform and/or educate people about one or other aspects of the past. It incorporates notions of

Scientific value	Description
	intactness, relevance, interpretative value and accessibility. Where archaeologists or others carrying out cultural heritage assessments are promoting/advocating the educational value of a cultural heritage item or place it is imperative that public input and support for this value is achieved and sought. Without public input and support the educative value of the items/places is likely to not ever be fully realised.
Aesthetics	In relation to heritage places, aesthetic significance is generally taken to mean the visual beauty of the place. Aesthetic value is not inherent in a place but arises in the sensory response people have to it. The guidelines provide no expectation for archaeologists to consider aesthetic values, it is often the case that the aesthetics including the physical setting of an archaeological site or a landscape contributes to its cultural heritage significance. Examples of archaeological sites that may have high aesthetic values include rock art sites or sites located in environments that evoke strong sensory responses.

12.1.2.1 Grading scientific values

The following gradations, where a site or zone satisfies at least one criterion, have been applied to provide a measure of the values/significance for Aboriginal objects identified within the Subject Area, and to provide an overall assessment of the significance of each of the zones used that define the Subject Area.

Table 11: Criteria for grading significance

Gradation	Description
Low	The site or object contains only a single or limited number of features, and has no potential to meaningfully inform our understanding of the past beyond what it contributes through its current recording (i.e. no or low research potential). The site or object is a representative but unexceptional example of the most common class of sites or objects in the region. Many more similar examples can be confidently predicted to occur within the Subject Area, and in the region.
Moderate	The site or object derives value because it contains features, both archaeological and contextual, which through further investigation may contribute to our understanding of the local past. These features include, but are not limited to: the relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a relatively large assemblage of stone artefacts. The presence of a diverse artefact and feature assemblage, and connectedness with landscape features and other notable sites provide relatively higher representative and rarity values than sites of low significance.
High	The site or object has value because it contains archaeological and/or contextual features which through further investigation may significantly contribute to our understanding of the past, both locally and on a regional scale. These features include, but are not limited to: Aboriginal ancestral remains; the site's relationship with landscape features or other Aboriginal archaeological sites or areas of identified heritage importance; diagnostic archaeological or landscape features that inform a chronology; and a very large assemblage of stone artefacts associated with other features such as oven remains or shell midden. Such sites will be relatively rare, and will be representative of a limited number of similar sites that make up this class; hence they derive high representative and rarity values.

12.2 Assessment of archaeological significance

Assessments of the Aboriginal cultural heritage site s identified within the Subject Area are presented below in Table 12 and Table 13.

Table 12: Identified values of Aboriginal cultural heritage site Anna Bay PAD 1 (AHIMS ID 38-5-0347)

Aboriginal cultural heritage site details	Anna Bay PAD 1 (AHIMS ID 38-5-0347)
Statement of significance	Not an Aboriginal cultural heritage site.
Submissions	Full copies of the submissions made from the RAPs are presented in Appendix C.

Table 13: Identified values of Aboriginal cultural heritage site NBRd 4 (AHIMS ID#38-5-0320)

Aboriginal cultural heritage site details	NBRd 4 (AHIMS ID#38-5-0320)
Statement of significance	The overall archaeological value of NBRd 4 AHIMS ID#38-5-0320 is considered to be low to moderate. Assessment of each of the criteria for archaeological (scientific) value and significance is presented below.
Social or cultural values	No specific cultural or social values have yet been attributed to the NBRd 4 Aboriginal cultural heritage site specifically, but the wider project area is located close to a noted Aboriginal Place and the broader areas are very significant to local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to their ancestors and storylines.
Historic value	The Subject Area has been used as a small-hold farm property since European settlement in the region in the mid nineteenth century. The Aboriginal cultural heritage site is located north of sand dunes, which are connected to the Port Stephens Local Environmental Plan (LEP) listed “Stockton Beach Dune System”, an item of local heritage significance. The heritage curtilage for this item terminates approximately 3 km to the west of the Subject Area. Also, a listed Aboriginal Place at Birubi Point, and a local heritage item, the Birubi Point Cemetery, are located within two kilometres of the Subject Area. The second site of the Hannah (later called Anna) Bay School building is located to the east of the Subject Area, but this is outside its boundaries. Despite the proximity of listed heritage items and places, no historic significance has been attributed to the NBRd 4 Aboriginal cultural heritage site.

Scientific (Archaeological) value	The Aboriginal cultural heritage site has unknown scientific (archaeological) value. It is comprised of surface shell scatters with the potential for subsurface deposit. It may provide additional information regarding Aboriginal life in the local or regional area; however, as it will not be harmed during the proposed works for this project, it has not been further assessed,
Aesthetic value	The Aboriginal cultural heritage site has low aesthetic value.
Submissions	Full copies of the submissions made from the RAPs are presented in Appendix C.

13. Impact assessment

The Proponent intends to establish a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The main impacts of the development proposal include:

- The extraction of sand to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.
- This work will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

The *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH 2011) requires that both direct and indirect harm to Aboriginal objects and Aboriginal places be considered. Generally direct harm refers to occasions where an activity physically impacts an Aboriginal cultural heritage site or objects and therefore affects the heritage values possessed by the Aboriginal cultural heritage site or objects. Indirect harm is usually taken to mean harm stemming from secondary consequences of the activity, and may affect Aboriginal cultural heritage sites or objects as an indirect consequence of the activity. Examples of such indirect harm are increased visitors to an Aboriginal cultural heritage site, or increased erosion in an area as a result of an activity.

The proposed activity will not harm any known Aboriginal objects or deposits likely to contain Aboriginal objects. The previously recorded Aboriginal cultural heritage site (NBRd 4 AHIMS ID#38-5-0320) will not be impacted by the proposed works, as the section in close vicinity to the Aboriginal cultural heritage site has been already built and there are no significant modifications proposed for this road. The dynamic aeolian sand comprising the dune in the southern extent of the Subject Area will be targeted by the quarrying activities. The area in front of the dune will not be excavated during the works, this area will only be impacted by the operation of equipment and machinery. The archaeological test excavation of Anna Bay PAD 1 did not identify any Aboriginal objects. As a result, the investigations concluded that Anna Bay PAD 1 is not an Aboriginal cultural heritage site.

The RAPs have not identified any heritage values that would be harmed by the proposed activity.

Table 14: Impact assessment summary

ACHsite name and AHIMS ID	Type of harm	Degree of harm	Consequence of harm
NBRd 4 (AHIMS ID#38-5-0320)	None	None	No loss of values

14. Management and mitigation measures

14.1 Conservation Principles and Management Framework

The two founding principles behind the Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH 2011:12) are ecologically sustainable development and intergenerational equity. These principles hold that “the present generation should make every effort to ensure the health, diversity and productivity of the environment – which includes cultural heritage – is available for the benefit of future generations”.

The strong emphasis, as in the Burra Charter, is to quantify and understand the heritage values of a place, a site, or an object and exhaust avenues of avoiding harm to those values. If harm cannot be avoided then there must be consideration and implementation of strategies to minimise harm (OEH 2011:13).

It follows that the hierarchy for consideration in regards to management strategies available for surface stone artefacts and subsurface stone artefacts and areas of archaeological potential, fall into four general categories, in order of preference from a conservation perspective:

- avoidance and in-situ conservation;
- partial avoidance and partial in-situ conservation (includes partial harm);
- harm caused with mitigating circumstances such as collection or salvage; and
- unmitigated harm.

The four general categories (described above) have been considered in the following subsections with regard to both direct impacts (e.g. surface disturbance) and indirect impacts (e.g. monitoring activities).

The management and mitigation measures have been prepared in consideration of comments received from the RAPs during the consultation process. All comments received from the RAPs are considered in Section 3 of the ACHAR.

14.2 Designing to avoid

No harm to Aboriginal objects is proposed.

14.3 Mitigating harm

Though no harm to Aboriginal objects is proposed, the management and mitigation measures in Table 15 should be considered to ensure continued compliance with the NPW Act.

Table 15: Consideration of management and mitigation strategies

Management Risk / Impacted Value	Strategies considered	Response
Management Risk – Compliance and Unexpected Finds (excluding human remains)	Communication to employees, site visitors, contractors and landowners	- All workers should be inducted into the Subject Area so they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> and any conditions of any future consent with respect to Aboriginal heritage prior and during and after construction activities. - In the unlikely event of the identification of artefacts within the Subject Area, work in the surrounding area is to stop immediately. - A temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site. - In consultation with the RAPS for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material. - If the material is an Aboriginal object, the Proponent will notify: - the BCD's Enviroline on 131 555; and - representatives of the RAPS. - Facilitate, in co-operation with the appropriate authorities and the RAPS: - The recording and assessment of the finds - Compliance with any legal requirements and BCD directions - The development and implementation of appropriate management strategies based on an assessment of significance of the finds. - Recommencement of ground disturbance works may only resume once legal requirements are fulfilled
Management Risk – Unexpected Finds – human remains	Stop work and follow procedure for discovery of suspected human remains	- All workers should be inducted into the Subject Area so they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> and any conditions of consent prior and during and after construction activities - In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately. - The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. - The NSW Police must be contacted immediately.

Management Risk / Impacted Value	Strategies considered	Response
		• No further action is to be undertaken until the NSW Police provide written notification to the Proponent. • If the skeletal remains are identified as Aboriginal, The Proponent or their agent must contact: ▪ the BCD's Enviroline on 131 555; and ▪ representatives of the RAPs. • No works are to continue until the BCD provides written notification to the proponent or their Agent. • An Aboriginal Heritage Impact Permit may be required to manage human remains.

15. Recommendations

The ACHA was carried out in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (Department of Environment, Climate Change and Water NSW, 2010). The assessment involved consultation with RAPs in accordance with the *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010* and their participation in the field survey and test excavation (details of which are in Section 3 and Appendix C of the ACHAR). One Aboriginal cultural heritage site was relocated during the field survey, but no Aboriginal Objects were identified during the test excavation.

Based on the results of the investigation, and with consideration to community consultation with the RAPs for the Project, Niche provides the following recommendations to assist with the management of Aboriginal objects and their associated values during future development of the Subject Area:

Table 16: Recommendations

Recommendations	
1.	All workers should be inducted into the Subject Area so they are made aware of their obligations under the <i>National Parks and Wildlife Act 1974</i> prior and during and after construction activities
2.	The following 'Find Procedure' should be put in place as a minimum response in the unlikely event of the identification of artefacts within the Subject Area: • work in the surrounding area is to stop immediately; • a temporary fence is to be erected around the Aboriginal cultural heritage site, with a buffer zone of at least 10 metres around the known edge of the Aboriginal cultural heritage site; • in consultation with the RAPs for the project, an appropriately qualified archaeological consultant is to be engaged to identify the material; and • If the material is an Aboriginal objects, the Proponent will notify: ○ the BCD's Enviroline on 131 555; and ○ representatives of the RAPs. • Facilitate, in co-operation with the appropriate authorities and the RAPs: ○ The recording and assessment of the finds ○ Compliance with any legal requirements and BCD directions ○ The development and implementation of appropriate management strategies based on an assessment of significance of the finds. • Recommencement of ground disturbance works may only resume once legal requirements are fulfilled
3.	In the unlikely event that suspected human remains are encountered during construction, all work in the area that may cause further impact, must cease immediately and: • The location, including a 20 m curtilage, should be secured using barrier fencing to avoid further harm. • The NSW Police must be contacted immediately. • No further action is to be undertaken until the NSW Police provide written notification to the Proponent. • If the skeletal remains are identified as Aboriginal, the Proponent or their agent must contact:

Recommendations

- the BCD's Enviroline on 131 555; and
- representatives of the RAPs.
- No works are to continue until the BCD provides written notification to the proponent or their Agent.

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Annex A: AHIMS search results and site cards

AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0074	Lemon Tree Passage; Contact	AGD	56	409750	6375150	Open site	Valid	Shell : -, Artefact : -	Midden	233,102218
38-5-0090	B F 2; Contact	AGD	56	410400	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0091	B F 3; Contact	AGD	56	410400	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0092	B F 4; Contact	AGD	56	410300	6372100	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0093	B F 5; Contact	AGD	56	410100	6372000	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0094	B F 7; Contact	AGD	56	409900	6371900	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0095	B F 6; Contact	AGD	56	410100	6371900	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0099	B F 11; Contact	AGD	56	409300	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0100	B F 12; Contact	AGD	56	409300	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0101	B F 13; Contact	AGD	56	409400	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0102	B F 14; Contact	AGD	56	409600	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0103	B F 15; Contact	AGD	56	409600	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0104	B F 16; Contact	AGD	56	409700	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0105	B F 17; Contact	AGD	56	409700	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0106	B F 18; Contact	AGD	56	409100	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0107	B F 19; Contact	AGD	56	409000	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0122	Anna Bay 2; Contact	AGD	56	411200	6372100	Open site	Valid	Shell : -, Artefact : -	Midden	1845,102128

Report generated by AHIMS Web Service on 09/08/2018 for Jess Cuskelly for the following area at Lat, Long From : -32.7869, 152.0326 - Lat, Long To : -32.7509, 152.0897 with a Buffer of 1000 meters. Additional Info : ACHA. Number of Aboriginal sites and Aboriginal objects found is 105

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0123	Anna Bay 3; Contact	AGD	56	411100	6372000	Open site	Valid	Shell : -, Artefact : -	Midden	1845,102128
38-5-0124	Anna Bay 4; Contact	AGD	56	410900	6372100	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0125	Anna Bay 5; Contact	AGD	56	410800	6372100	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0126	Anna Bay 6; Contact	AGD	56	410700	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0127	Anna Bay 7; Contact	AGD	56	410700	6372000	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0128	Anna Bay 8; Contact	AGD	56	410700	6372100	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0129	Anna Bay 9; Contact	AGD	56	410500	6371900	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0130	Anna Bay 10; Contact	AGD	56	410400	6371900	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0131	Anna Bay 11; Contact	AGD	56	410300	6372000	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0153	Isolated Artefact Fishermans Bay 1; Contact	AGD	56	414850	6372200	Open site	Valid	Artefact : -	Isolated Find	3184
38-5-0108	B F 20; Contact	AGD	56	408900	6372200	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0109	B F 21; Contact	AGD	56	408900	6372200	Open site	Valid	Shell : -, Artefact : -, Stone Quarry : -	Midden,Quarry	1845
38-5-0110	Mona Point 1; Contact	AGD	56	415600	6375400	Open site	Valid	Artefact : -	Open Camp Site	1845,102128,1 02218
38-5-0114	NB1 Contact	AGD	56	410800	6372650	Open site	Valid	Artefact : -	Open Camp Site	2078,4645
38-5-0115	NB2; Contact	AGD	56	410200	6372350	Open site	Valid	Shell : -, Artefact : -	Midden	2078,2978
38-5-0116	Fenninghams Island 1; Contact	AGD	56	408900	6375900	Open site	Valid	Shell : -, Artefact : -	Midden	1845
38-5-0117	Fenninghams Island 2;	AGD	56	409200	6375600	Open site	Valid	Shell : -, Artefact : -	Midden	1845

Report generated by AHIMS Web Service on 09/08/2018 for Jess Cuskelly for the following area at Lat, Long From : -32.7869, 152.0326 - Lat, Long To : -32.7509, 152.0897 with a Buffer of 1000 meters. Additional Info : ACHA. Number of Aboriginal sites and Aboriginal objects found is 105

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0012	Morna Point;Birubi Point;	AGD	56	413527	6372058	Open site	Valid	Shell : -, Artefact : -	Midden	102128,102382
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>	747	
38-5-0013	Birubi point;Morna Point;	AGD	56	413527	6372058	Open site	Valid	Artefact : -, Shell : -	Midden,Open Camp Site	102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0014	Birubi Point/Annabay;Morna Point;Birubi point;	AGD	56	413550	6372200	Open site	Valid	Shell : -, Artefact : -	Midden,Open Camp Site	1845,102128,102382
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>	1026,1054,1058	
38-5-0015	Morna Point;Birubi Point;	AGD	56	413624	6371786	Open site	Valid	Shell : -, Artefact : -	Midden	102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0016	Morna Point;Birubi Point; Headland Midden	AGD	56	413624	6371724	Open site	Valid	Shell : -, Artefact : -	Midden	309,315,1457,102128,102218,102382
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0034	Morna Point;Cemetery Point;	AGD	56	413775	6371975	Open site	Valid	Burial : -	Burial/s	102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0118	Fenninghams Island 3;	AGD	56	408920	6375700	Open site	Valid	Shell : -, Artefact : -	Midden	1845
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0119	Fenninghams Island 4;	AGD	56	408920	6375700	Open site	Valid	Shell : -, Artefact : -	Midden	1845,102218
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0120	Fenninghams Island 5;	AGD	56	408980	6375300	Open site	Valid	Shell : -, Artefact : -	Midden	1845,102218
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0121	Anna Bay 1;	AGD	56	411400	6372400	Open site	Valid	Shell : -, Artefact : -	Midden	1845,102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0196	STOCKTON BIGHT	AGD	56	413500	6372500	Open site	Valid	Artefact : -		102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0198	ANNA BAY	AGD	56	412500	6372550	Open site	Valid	Artefact : -		1845,102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0210	Stockton Bight Anna Bay 4wd access	AGD	56	413400	6372800	Open site	Valid	Artefact : -		102128
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>	3575	
38-5-0219	Tomaree 3	AGD	56	409200	6373700	Open site	Valid	Shell : 1		102218
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		
38-5-0220	Tomaree 4	AGD	56	409500	6373700	Open site	Valid	Shell : 1		
	<u>Contact</u>	<u>Recorders</u>						<u>Permits</u>		

Report generated by AHIMS Web Service on 09/08/2018 for Jess Cuskelly for the following area at Lat, Long From : -32.7869, 152.0326 - Lat, Long To : -32.7509, 152.0897 with a Buffer of 1000 meters. Additional Info : ACHA. Number of Aboriginal sites and Aboriginal objects found is 105

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0211	A1 - Stockton Bight	AGD	56	413300	6372600	Open site	Valid	Shell : -, Artefact : -, Hearth : -		102128
	<u>Contact</u>	<u>Recorders</u>	Mr.Warren Mayers					<u>Permits</u>		
38-5-0221	Tomaree 5	AGD	56	409750	6373700	Open site	Valid	Shell : 1		102218
	<u>Contact</u>	<u>Recorders</u>	Mrs.Angela Besant,Doctor.Tim Owen					<u>Permits</u>		
38-5-0222	Tomaree 6	AGD	56	410150	6373680	Open site	Valid	Artefact : 2, Shell : 2		
	<u>Contact</u>	<u>Recorders</u>	Mrs.Angela Besant					<u>Permits</u>		
38-5-0223	Tomaree 7	AGD	56	412454	6373889	Open site	Partially Destroyed	Artefact : 2, Shell : 2		102128,10221 8
	<u>Contact</u>	<u>Recorders</u>	Mrs.Angela Besant,Miss.Nicola Roche					<u>Permits</u>	3621	
38-5-0227	Iris Moore Reserve	AGD	56	414200	6371600	Open site	Valid	Shell : -, Hearth : -, Artefact : -		102128
	<u>Contact</u>	<u>Recorders</u>	Mr.Warren Mayers					<u>Permits</u>		
38-5-0239	AB1	AGD	56	413682	6372154	Open site	Valid	Artefact : -, Shell : -		98595,102128
	<u>Contact</u>	<u>Recorders</u>	MCH - McCardle Cultural Heritage Pty Ltd					<u>Permits</u>		
38-5-0240	AB2	AGD	56	413580	6372200	Open site	Valid	Artefact : -, Shell : -		98595,102128
	<u>Contact</u>	<u>Recorders</u>	MCH - McCardle Cultural Heritage Pty Ltd					<u>Permits</u>		
38-5-0241	AB3	AGD	56	413570	6372230	Open site	Valid	Artefact : -, Shell : -		98595,102128
	<u>Contact</u>	<u>Recorders</u>	MCH - McCardle Cultural Heritage Pty Ltd					<u>Permits</u>		
38-5-0246	Restriction applied. Please contact ahims@environment.nsw.gov.au.					Open site	Valid			
	<u>Contact</u>	<u>Recorders</u>	Ms.Penny McCardle					<u>Permits</u>	2260	
38-5-0245	Upton Midden	AGD	56	408644	6373823	Open site	Valid	Shell : 16		
	<u>Contact</u>	<u>Recorders</u>	Doctor.Tim Owen,Mr.Andy Collis					<u>Permits</u>		
38-5-0250	Anna Bay 1, NBR	AGD	56	411480	6373850	Open site	Valid	Artefact : 2, Shell : 1		102128
	<u>Contact</u>	<u>Recorders</u>	Mr.Peter Kuskie					<u>Permits</u>		
38-5-0248	GAN GAN 5	AGD	56	415449	6373282	Open site	Valid	Artefact : -		102128
	<u>Contact</u> Searle	<u>Recorders</u>	Stedinger Associates					<u>Permits</u>		
38-5-0261	Worimi Ancesral Remains Repatriation Site. Worimi Conservation Lands	AGD	56	409188	6372597	Open site	Valid	Burial : -		
	<u>Contact</u> Worimi Local Aboriginal Land	<u>Recorders</u>	Mr.Steve Brereton					<u>Permits</u>		
38-5-0268	Cec Dee open campsite2	AGD	56	413664	6372608	Open site	Valid	Habitation Structure : 15		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson					<u>Permits</u>		
38-5-0272	Anna Bay access track open campsite	AGD	56	413640	6372841	Open site	Valid	Artefact : 50		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson					<u>Permits</u>	3437	

Report generated by AHIMS Web Service on 09/08/2018 for Jess Cuskelly for the following area at Lat, Long From : -32.7869, 152.0326 - Lat, Long To : -32.7509, 152.0897 with a Buffer of 1000 meters. Additional Info : ACHA. Number of Aboriginal sites and Aboriginal objects found is 105

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0269	Cec Dee open campsite 3	AGD	56	413598	6372647	Open site	Valid	Aboriginal Resource and Gathering : 6		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0270	Cec Dee open campsite 4	AGD	56	413598	6372765	Open site	Valid	Artefact : 3		102128
	<u>Contact</u>	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0291	Birubi open campsite	AGD	56	413479	6372580	Open site	Valid	Aboriginal Resource and Gathering : 100		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0292	Birubi open campsite transport corridor	AGD	56	413485	6372585	Open site	Valid	Aboriginal Resource and Gathering : 50		
	<u>Contact</u> Mr.Peter Anderson	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0293	Birubi transport corridor campsite	AGD	56	413536	6372520	Open site	Valid	Aboriginal Resource and Gathering : 50		
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0294	Birubi access campsite	AGD	56	413540	6372530	Open site	Valid	Aboriginal Resource and Gathering : 60		
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0295	Gan Gan road beach access	AGD	56	413505	6372540	Open site	Valid	Aboriginal Resource and Gathering : 71		
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0296	Gan Gan Road Site	AGD	56	413482	6372570	Open site	Valid	Aboriginal Resource and Gathering : 37		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u>							
38-5-0280	Robinson's Quarry open campsite 5	AGD	56	413531	6372845	Open site	Valid	Aboriginal Resource and Gathering : 5		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u> 3437,3575							
38-5-0035	Morna Point Fisherman's Bay	AGD	56	414872	6371460	Open site	Valid	Artefact : -	Open Camp Site	315,102128
	<u>Contact</u>	<u>Recorders</u>	Unknown Author <u>Permits</u>							
38-5-0089	B F 1;	AGD	56	410600	6372300	Open site	Valid	Shell : -, Artefact : -	Midden	1845
	<u>Contact</u>	<u>Recorders</u>	Pam Dean-Jones,Bonhomme Craib & Associates <u>Permits</u>							
38-5-0281	Robinsons Quarry open campsite 4	AGD	56	413596	6372853	Open site	Valid	Aboriginal Resource and Gathering : 7		
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u> 3437							
38-5-0282	Robinsons quarry open campsite 3	AGD	56	413590	6372820	Open site	Valid	Aboriginal Resource and Gathering : 5		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u> 3437							
38-5-0283	Robinson Quarry open campsite 2	AGD	56	413616	6372854	Open site	Valid	Aboriginal Resource and Gathering : 7		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	Mr.Leonard (Lennie) Anderson <u>Permits</u> 3437							

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0284	Birubi access open campsite	AGD	56	413468	6372600	Open site	Valid	Aboriginal Resource and Gathering : 6		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	<u>Permits</u>							
38-5-0285	Birubi swail entrance	AGD	56	413457	6372580	Open site	Valid	Habitation Structure : 8		
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	<u>Permits</u>							
38-5-0286	Buruibi Track	AGD	56	413451	6372590	Open site	Valid	Aboriginal Resource and Gathering : 15		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	<u>Permits</u>							
38-5-0288	Robinsons Sand Quarry campsite 1	AGD	56	413620	6372860	Open site	Valid	Aboriginal Resource and Gathering : 20		102128
	<u>Contact</u> Mr.Leonard (Lennie) Andersor	<u>Recorders</u>	<u>Permits</u> 3437							
38-5-0303	NBR PAD 02	GDA	56	409790	6373866	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0304	NBR PAD 01	GDA	56	409538	6373846	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0150	Fishermans Bay 1	AGD	56	414500	6371700	Open site	Valid	Artefact : -	Isolated Find	102128
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u> 1065							
38-5-0309	Landcom FB1	GDA	56	414959	6372070	Open site	Valid	Artefact : 1		
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0098	B F 10;	AGD	56	408600	6371800	Open site	Valid	Shell : -, Artefact : -	Midden	1845
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0320	NBRd 4	GDA	56	412046	6373942	Open site	Valid	Shell : 1		103447
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0321	NBRd 5	GDA	56	411292	6373875	Open site	Valid	Shell : 1		103447
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0322	NBRd 6	GDA	56	409468	6373900	Open site	Valid	Shell : 1		103447
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0317	RPS Birubi Pt Midden 1	GDA	56	413492	6372316	Open site	Valid	Shell : -		
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u>							
38-5-0318	OFOC4	GDA	56	413195	6373870	Open site	Partially Destroyed	Shell : 1		
	<u>Contact</u>	<u>Recorders</u>	<u>Permits</u> 3621,3758							

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AHIMS Web Services (AWS)

Extensive search - Site list report

Your Ref/PO Number : 4017_Basic Search

Client Service ID : 363187

SiteID	SiteName	Datum	Zone	Easting	Northing	Context	Site Status	SiteFeatures	SiteTypes	Reports
38-5-0319	OFOC5	GDA	56	412500	6373988	Open site	Partially Destroyed	Shell : 1		
	Contact	Recorders	Umwelt (Australia) Pty Limited, Miss. Nicola Roche, Miss. Nicola Roche							Permits 3621,3758
38-5-0316	Surf Club Midden - Birubi Pt	GDA	56	413415	6372385	Open site	Partially Destroyed	Shell : 1		103888
	Contact	Recorders	Miss. Philippa Sokol, RPS East Australia Pty Ltd - Echuca Victoria							Permits 3607
38-5-0312	NBR3/2 artefact scatter	AGD	56	412210	6373957	Open site	Valid	Artefact : -		
	Contact	Recorders	MCH - McCardle Cultural Heritage Pty Ltd, Ms. Penny McCardle							Permits
38-5-0310	NBR3/3 shell midden	AGD	56	412111	6373980	Open site	Valid	Artefact : -, Shell : -		103447
	Contact	Recorders	Ms. Penny McCardle							Permits 3528,3564
38-5-0311	NBR3/ PAD1	AGD	56	412110	6373980	Open site	Valid	Potential Archaeological Deposit (PAD) : -		
	Contact	Recorders	MCH - McCardle Cultural Heritage Pty Ltd, Ms. Penny McCardle							Permits
38-5-0326	RPS NBR AS1	GDA	56	410044	6374068	Open site	Valid	Artefact : 1		
	Contact	Recorders	Mr. Jeremy Hill							Permits 4226
38-5-0327	Ausgrid Anna Bay IF1	GDA	56	412517	6373648	Open site	Valid	Artefact : -		
	Contact	Recorders	Miss. Stephanie Howden							Permits
38-5-0323	NBR3/PAD2	AGD	56	409632	6373635	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders	Ms. Penny McCardle							Permits
38-5-0324	NRB3/PAD3	AGD	56	411750	6373780	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders	Ms. Penny McCardle							Permits
38-5-0325	NBR3/PAD4	AGD	56	411800	6373784	Open site	Valid	Potential Archaeological Deposit (PAD) : 1		
	Contact	Recorders	Ms. Penny McCardle							Permits
38-5-0331	WCL1403	GDA	56	412543	6372831	Open site	Valid	Artefact : 1		
	Contact	Recorders	Ms. Nadine Russell							Permits
38-5-0338	4011 Nelson Bay Road A1	GDA	56	409756	6373969	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Ms. Tessa Boer-Mah, RPS Australia East Pty Ltd - Hamilton							Permits
38-5-0339	4011 Nelson Bay Road A2	GDA	56	409859	6374015	Open site	Destroyed	Artefact : -		
	Contact	Recorders	Ms. Tessa Boer-Mah, RPS Australia East Pty Ltd - Hamilton							Permits

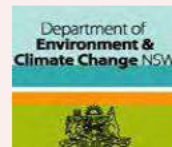
Report generated by AHIMS Web Service on 09/08/2018 for Jess Cuskelly for the following area at Lat, Long From : -32.7869, 152.0326 - Lat, Long To : -32.7509, 152.0897 with a Buffer of 1000 meters. Additional Info : ACHA. Number of Aboriginal sites and Aboriginal objects found is 105

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Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville NSW 2220



Office Use Only

Site Number 3 8 5 0 3 2 0

Date received / / Date entered into system / / Date catalogued / /

Entered by (I.D.)

Information Access

☐ Gender/male ☐ Gender/female ☐ Location restriction ☐ General restriction ☐ No access

For Further Information Contact:

☐ Nominated Trustee

Title Surname First Name Initials

Organisation

Address

Phone number Fax

☐ Knowledge Holder

Title Surname First Name Initials

Organisation

Address

Phone number Fax

Aboriginal Heritage Unit or Cultural Heritage Division Contacts

Office Use Only

Client on system

Client on system

Geographic Location

Site Name N B R d 4

Easting 4 1 2 0 4 6 Northing 6 3 7 3 9 4 2 AGD/GDA GDA

Mapsheet N c a s t l e , P o r t S t e p h

Zone 56

Location Method Non-Differential GPS

Other Registration

Primary Recorder

Title Surname First Name Initials

M s M c C a r d l e P e n n y

Organisation M c C a r d l e C u l t u r a l H e r i t a g e

Address P O B o x 1 6 6 A d a m s t o w n N S W 2 2 8

Phone number 0 4 1 2 7 0 2 3 9 6 Fax 5 9 5 2 5 5 0 1

Date recorded 29/05/2013

Client on system

page 2

Open Site

Landform

- ## Slope

degrees

- ☐ Upper slope
- ☐ Plain
- ☐ Ridge
- ☐ Tor
- ☐ Valley flat
- ☐ Levy

- ☐ Stream bank
- ☐ Stream channel
- ☐ Swamp
- ☐ Terrace
- ☐ Terrace flat

☐	Closed forest
☒	Grasslands
☒	Isolated clumps of trees
☐	Open forest
☐	Open woodland
☐	Scrub
☐	Woodland
☐	Cleared
☐	Revegetated
☐	N/A

- ☐ Conservation
- ☐ Established urban
- ☐ Farming-intensive
- ☐ Farming-low intensity
- ☐ Forestry
- ☐ Industrial
- ☐ Mining
- ☒ Pastoral/grazing
- ☐ Recreation
- ☐ Semi-rural
- ☐ Service corridor
- ☐ Transport corridor
- ☐ Urban expansion
- ☐ N/A

Distance to permanent water source

10 metres

Distance to temporary water source

metres

Name of nearest permanent water source

Name of nearest temporary water

Directions for Relocation

A 10x10 grid map. The grid is composed of 10 columns and 10 rows of squares. The corners are labeled with compass directions: NW (top-left), NE (top-right), SW (bottom-left), and SE (bottom-right). The midpoints of the top and bottom edges are labeled 'N' and 'S' respectively. The midpoints of the left and right edges are labeled 'W' and 'E' respectively. A north arrow is located on the right side of the grid, pointing upwards, with the letter 'N' above it.

☐ Public	National Park / other Government Dept.
☐ Private	

I.D. (I.D. Office Use only)

[illegible]

General Site Information

Closed Site

Shelter/Cave Formation

- ☐ Boulder
☐ Wind erosion
☐ Water erosion
☐ Rock collapse

Rock Surface Condition

- ☐ Boulder
☐ Sandstone platform
☐ Silica gloss
☐ Tessellated
☐ Weathered
☐ Other platform

Condition of Ceiling

- ☐ Boulder
☐ Sandstone platform
☐ Silica gloss
☐ Tessellated
☐ Weathered
☐ Other platform

Shelter Aspect

- ☐ North
☐ North East
☐ East
☐ South East
☐ South
☐ South West
☐ West
☐ North West

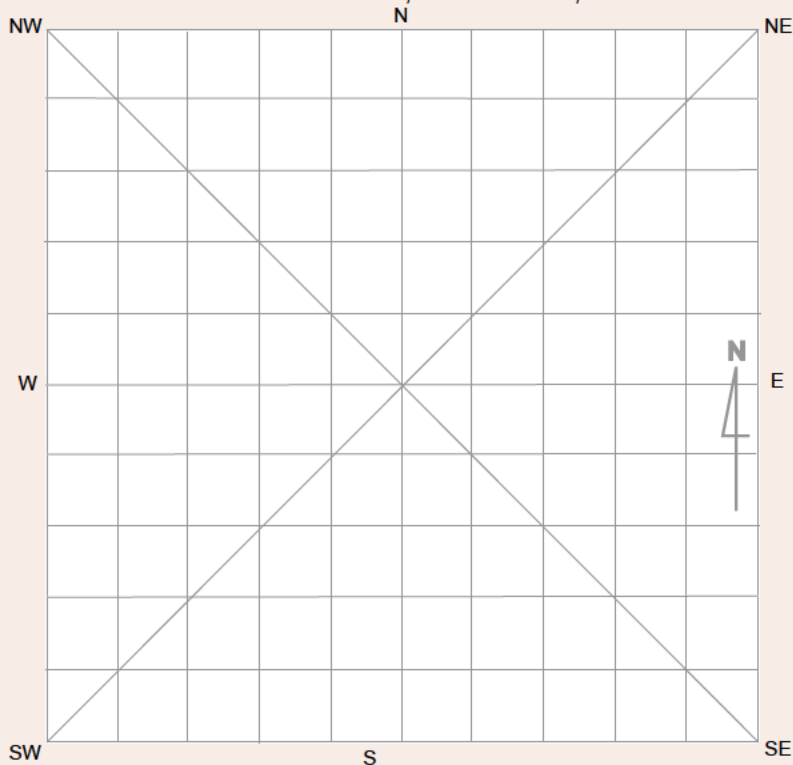
Open Site

Site Orientation

- ☒ N-S
☐ NE-SW
☐ E-W
☐ SE-NW
☐ N/A

Features

- ☐ 1. Aboriginal Ceremony & Dreaming
☐ 2. Aboriginal Resource & Gathering
☐ 3. Art
☐ 4. Artefact
☐ 5. Burial
☐ 6. Ceremonial Ring
☐ 7. Conflict
☐ 8. Earth Mound
☐ 9. Fish Trap
☐ 10. Grinding Groove
☐ 11. Habitation Structure
☐ 12. Hearth
☐ 13. Non Human Bone & Organic Material
☐ 14. Ochre quarry
☐ 15. Potential Archaeological Deposit
☐ 16. Stone Quarry
☒ 17. Shell
☐ 18. Stone Arrangement
☐ 19. Modified Tree
☐ 20. Water Hole

Site Plan Indicate scale, boundaries of site, features

Site Dimensions

Closed Site Dimensions (m)

- Internal length
 Internal width
 Shelter height
 Shelter floor area

Open Site Dimensions (m)

- 1.5m Total length of visible site
 1.5m Average width of visible site
 Estimated area of visible site
 Length of assessed site area

AHIMS site ID: 38-5-0347

Date recorded: 18-02-2019

Site Location Information

Site name: Anna Bay PAD 1

Easting: 412042

Northing: 6373398

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m):

25

Zone: 56

Location method:

Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title

Surname

First name

Dr.

Disspain

Morgan

Organisation:

Niche Environment and Heritage

Address:

Phone:

0488774566

E-mail:

mdisspain@niche-eh.com

Site Context Information

Land Form
Pattern:

Dune Field

Land Use:

Mining

Land Form
Unit:

Dune

Vegetation:

Isolated clumps of trees

Distance to
Water (m):

1.23

Primary
Report:

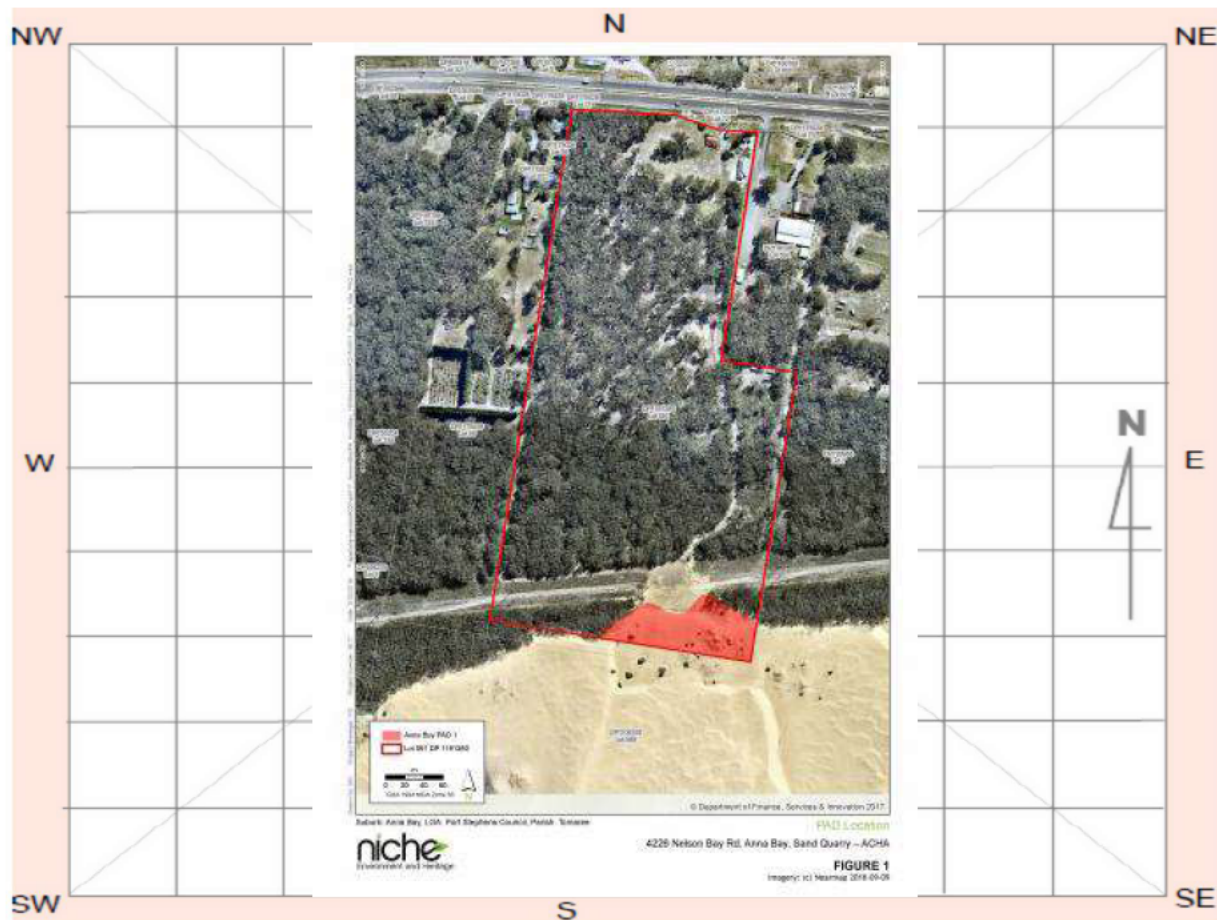
How to get
to the site:

The PAD is located within the southern portion of Lot591 DP1191380.
Access is through the lot, which is private property and requires
access permission. Address is 4226 Nelson Bay Road.

Other site
information:

A large, cleared and maintained transmission line easement is located
directly north of the PAD. Pad likely to have experienced disturbance
during easement construction, clearing of vegetation and aeolian
movement of dune system.

Site location map



Site contents information

open/closed site:

Open

Site condition:

Unstable Struct

Features:

1.

Potential Archaeological Deposit

Number of
features

Length of
feature(s)
extent (m)

180

Width of
feature (s)
extent (m)

60

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar shape

Tree Species

Description:

The PAD encompasses the immediate vicinity and foreground of a dynamic sand dune. The boundaries are determined by the Subject Area under assessment, and the PAD could extend beyond. The current coastline is located approx. 1.1 km to the south across a highly dynamic dune field.

Features:

2.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar shape

Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
3.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
4.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

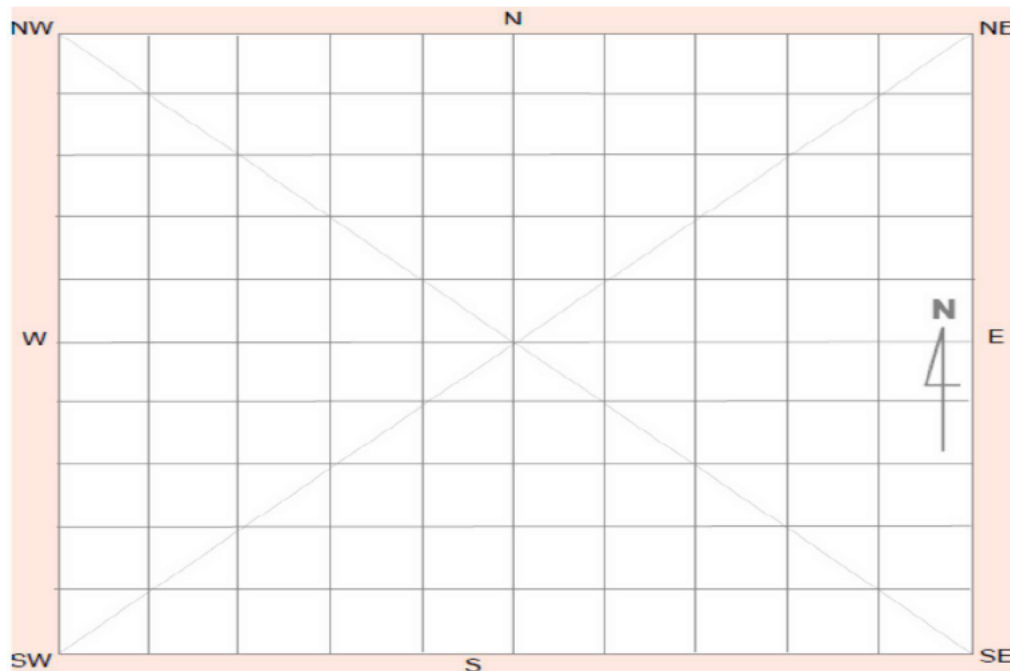
	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
5.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Other Site Info:

A large, cleared and maintained transmission line easement is located directly north of the PAD. Pad likely to have experienced disturbance during easement construction, clearing of vegetation and aeolian movement of dune system.

Site plan

Site photographs



Description: Anna Bay PAD1 dune surface facing west



Description: Anna Bay PAD1 dune surface facing east



Description: Anna Bay PAD1 transmission easement



Description: Ann Bay PAD dune ground surface

Site restrictions

Do you want to
Restrict this site?:

☐

Restriction type:

Gender

☐

General

☐

Location

☐

Why is this site restricted?:

Further information contact

Title

Surname

First name

Organisation:

Address:

Phone:

E-mail:

Annex B: Test excavation data

Top of Dune Test Pit DT-TP-01

Table 17: Spit and soil descriptions for DT-TP-01

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 7: DT-TP-01



Plate 8: Section View of DT-TP-1

Top of Dune Test Pit DT-TP-02

Table 18: Spit and soil descriptions for DT-TP-2

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 9: DT-TP-2

Top of Dune Test Pit DT-TP-03

Table 19: Spit and soil descriptions for DT-TP-3

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 10: DT-TP-3

Top of Dune Test Pit DT-TP-04

Table 20: Spit and soil descriptions for DT-TP-4

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow

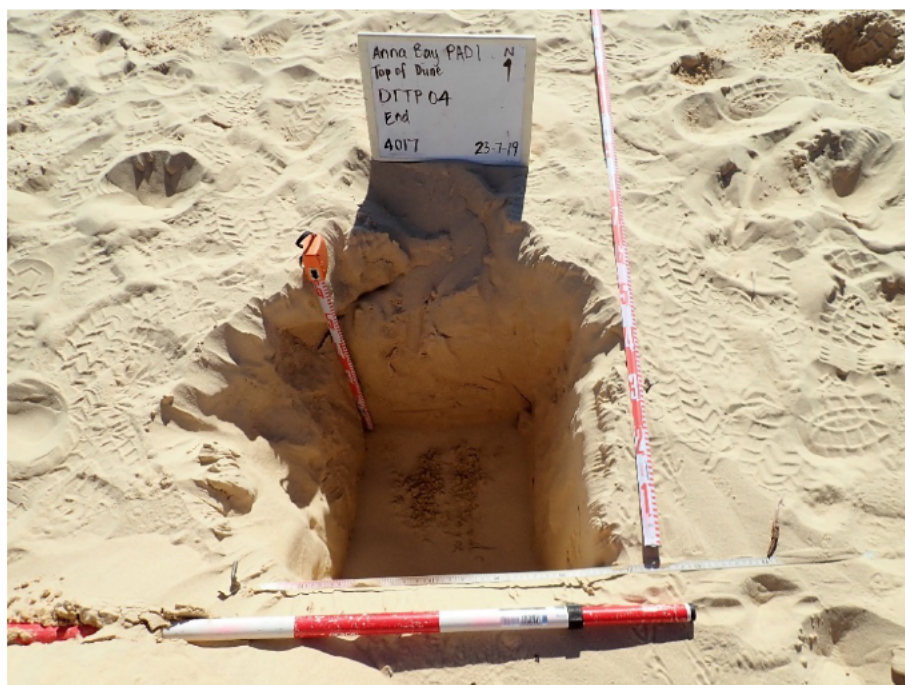


Plate 11: DT-TP-4



Plate 12: Section View of DT-TP-4

Top of Dune Test Pit DT-TP-05

Table 21: Spit and soil descriptions for DT-TP-5

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 13: DT-TP-5

Top of Dune Test Pit DT-TP-06

Table 22: Spit and soil descriptions for DT-TP-6

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean and slightly damp sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 14: DT-TP-6



Plate 15: Section View of DT-TP-6

Top of Dune Test Pit DT-TP-07

Table 23: Spit and soil descriptions for DT-TP-7

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-60 cm	Loose and clean sand (loose consistency).	None	10YR/7/4	8	Very pale brown
2	60-65 cm	Loose, finely grained, clean and slightly damp sand up to approximately 600mm (loose consistency). Darker brown sediment throughout (humic soil). Disturbed by roots.	None	10YR/6/3	7.5	Pale brown



Plate 16: DT-TP-7



Plate 17: Section View of DT-TP-7

Top of Dune Test Pit DT-TP-08

Table 24: Spit and soil descriptions for DT-TP-8

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose, finely grained, clean sand (loose consistency).	None	10YR/8/6	7	Yellow



Plate 18: DT-TP-8



Plate 19: Section View of DT-TP-8

Top of Dune Test Pit DT-TP-09

Table 25: Spit and soil descriptions for DT-TP-9

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Clean and slightly damp sand (loose consistency). Disturbances include small roots on the northern wall.	None	10YR/8/6	7	Yellow



Plate 20: DT-TP-9

Top of Dune Test Pit DT-TP-10

Table 26: Spit and soil descriptions for DT-TP-10

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-65 cm	Loose and clean sand (loose consistency).	None	10YR/8/6	7	Yellow

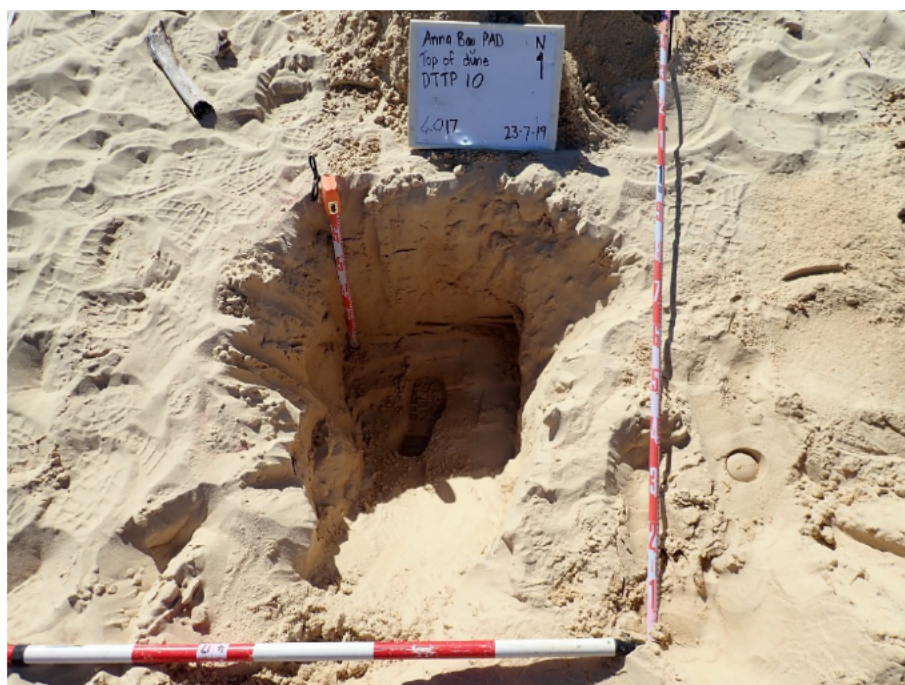


Plate 21: DT-TP-10

Bottom of Dune Test Pit DT-TP-01

Table 27: Spit and soil descriptions for DT-TP-01

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Loose, finely grained, dry sand (loose consistency).	None	10YR/8/6	7	Yellow
2	5-15 cm	Damp humic sand (loose consistency). Disturbed by roots and decomposed wood/vegetation.	None	10YR/5/2	7.5	Greyish brown
3	15-25 cm	Sand with high amount of humic material (loose to compact consistency). Disturbed by roots and decomposed wood/vegetation.	None	N/A	N/A	N/A
4	25-35 cm	Dark brown humic deposit (loose consistency).	None	10YR/3/1	7	Very dark grey



Plate 22: DB-TP-01



Plate 23: Section View of DB-TP-01

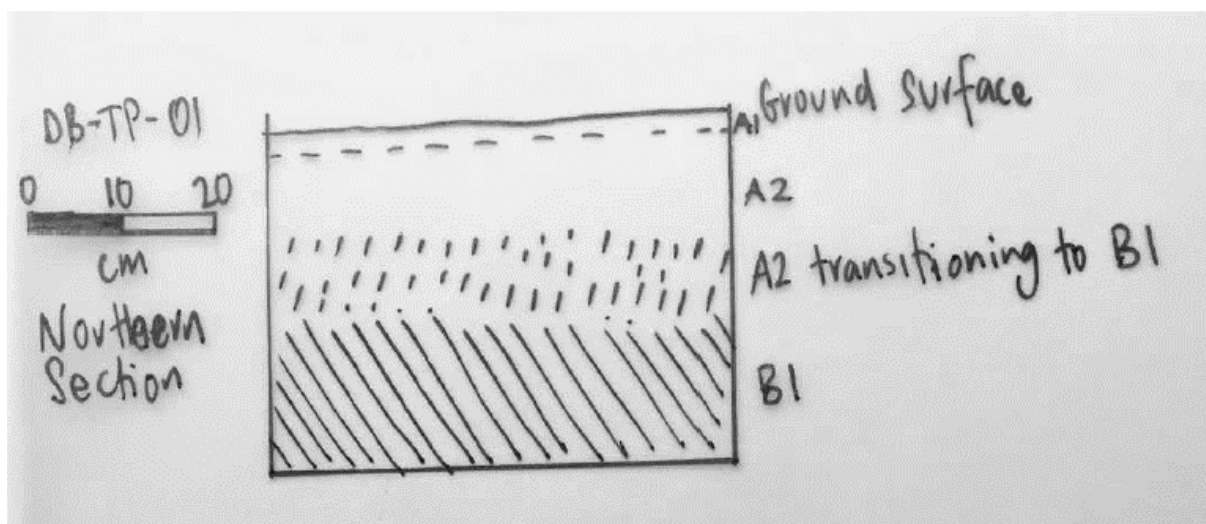


Plate 24: Section drawing DB-TP-01

Bottom of Dune Test Pit DT-TP-02

Table 28: Spit and soil descriptions for DB-TP-02

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Loose, clean and dry sand (loose consistency).	None	10YR/8/6	7	Yellow
2	5-15 cm	Soft damp sand (friable consistency). Disturbed by roots in northern wall.	None	N/A	N/A	N/A
3	15-25 cm	Clean sand mixed with some humic material (firm consistency).	None	10YR/5/2	7.5	Greyish brown
4	25-35 cm	Dark brown humic deposit (firm consistency).	None	N/A	N/A	N/A



Plate 25: DB-TP-02



Plate 26: Section View of DB-TP-02

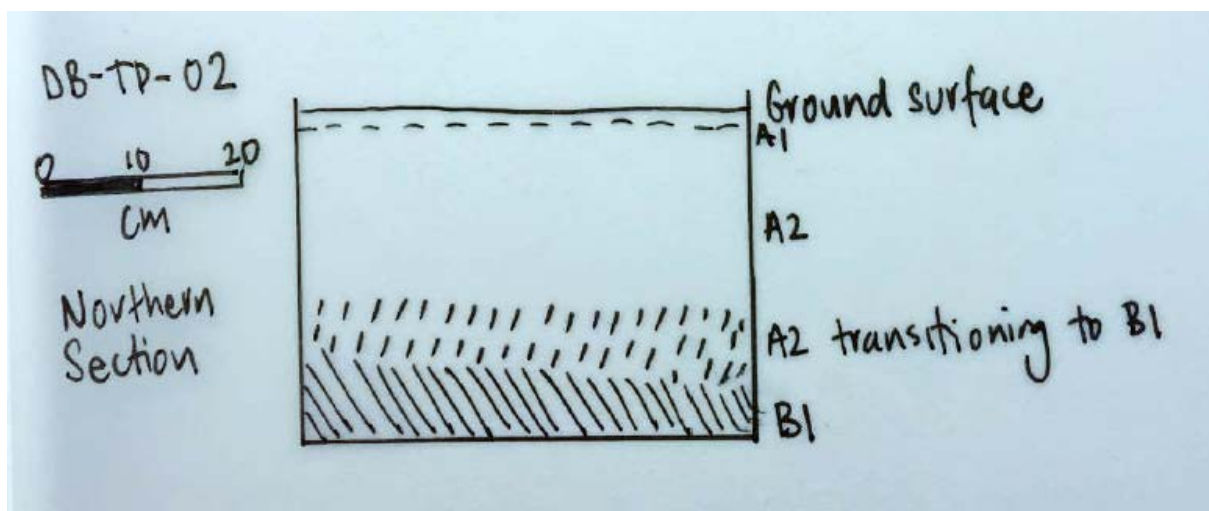


Plate 27: Section drawing DB-TP-02

Bottom of Dune Test Pit DT-TP-03

Table 29: Spit and soil descriptions for DB-TP-03

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Loose, finely grained, dry sand (loose consistency).	None	10YR/8/6	7	Yellow
2	5-15 cm	Sand that is clean, damp with small amounts of introduced fill of gravel material (loose consistency). Disturbed by introduced fill (gravel material).	None	N/A	N/A	N/A
3	15-25 cm	Sand that is clean, damp with small amounts of humic material (friable consistency).	None	N/A	N/A	N/A
4	25-35 cm	Dark brown and damp humic deposit about 32 cm deep (friable to firm consistency).	None	10YR/5/2 10YR/5/1	7.5 7	Greyish brown Grey
5	35-45 cm	Sand mixed with humic material (friable to firm consistency).	None	N/A	N/A	N/A
6	45-55 cm	Dark brown/blackish sand which is finely grained (friable to firm consistency).	None	10YR/3/1	7	Grey
7	55-65 cm	Dark brown/blackish sand which is finely grained (firm consistency).	None	N/A	N/A	N/A
8	65-75 cm	Dark brown/blackish sand (friable to firm consistency). Giving way to grey sand which is softer and not as compacted (coarser grained).	None	10YR/4/1	6.5	Dark grey
9	75-85 cm	Soft, grey sand (friable consistency).	None	N/A	N/A	N/A
10	85-95 cm	Soft grey sand which is slightly lighter in colour and increasingly lighter with depth (loose to friable consistency).	None	10YR/5/1	6	Grey
11	95-105 cm	Soft grey sand which is clean and leaching of tannins by humic deposit above (loose consistency).	None	N/A	N/A	N/A
12	105-115 cm	Soft grey sand which is clean and sterile (loose consistency).	None	N/A	N/A	N/A



Plate 28: DB-TP-03



Plate 29: Section View of DB-TP-03

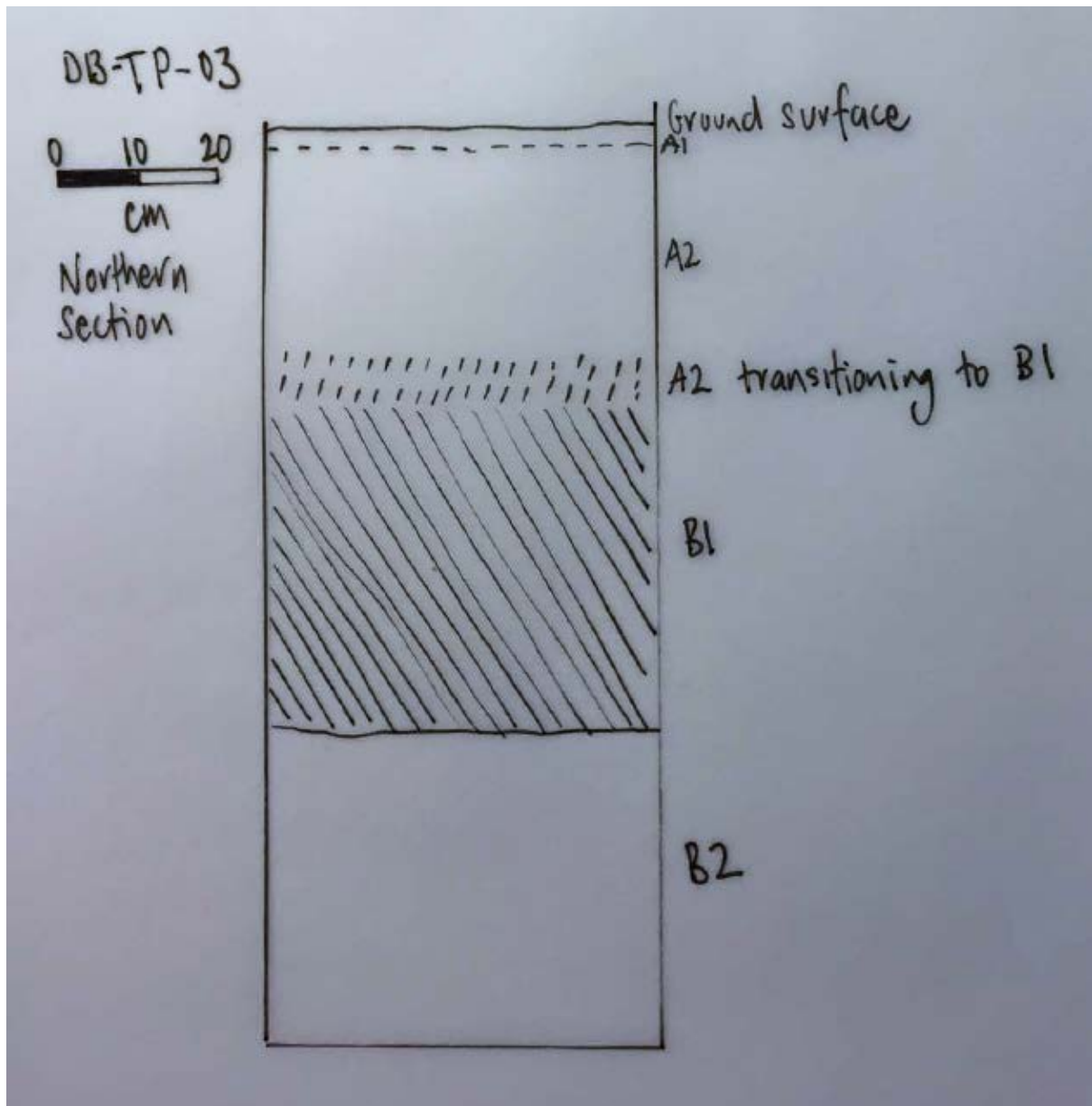


Plate 30: Section drawing DB-TP-03

Bottom of Dune Test Pit DT-TP-04

Table 30: Spit and soil descriptions for DB-TP-04

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Loose, finely grained, dry sand (loose consistency). Disturbed by introduced fill (gravel material).	None	N/A	N/A	N/A
2	5-15 cm	Soft, damp and clean sand (friable consistency).	None	10YR/8/6	7	Yellow
3	15-25 cm	Humic material coming through at 10-25 cm (friable consistency). Disturbed by decomposing humic material, possibly mulch.	None	10YR/5/2	7.5	Greyish brown
4	25-45 cm	Dark brown humic deposit (friable to firm to compact consistency).	None	10YR/5/1	7	Grey
5	45-55 cm	Grey sterile sand at approximately 53 cm depth (friable to firm consistency).	None	N/A	N/A	N/A



Plate 31: DB-TP-04



Plate 32: Section View of DB-TP-04

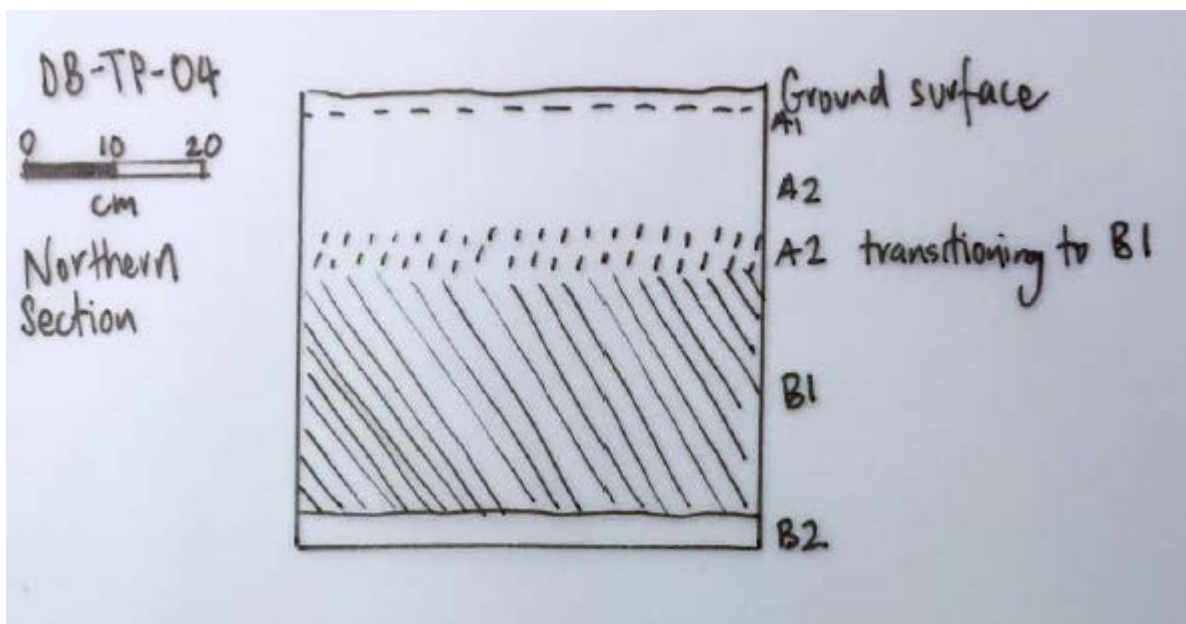


Plate 33: : Section drawing DB-TP-04

Bottom of Dune Test Pit DT-TP-05

Table 31: Spit and soil descriptions for Test Pit 5

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Loose, finely grained, dry sand (loose consistency). Disturbed by introduced material, broken glass, gravel and ceramic fill.	None	10YR/8/6	7	Yellow
2	5-15 cm	Clean soft sand with small amounts of humic material (loose to friable consistency).	None	N/A	N/A	N/A
3	15-25 cm	Clean soft sand with small amounts of humic material increasing with depth (loose to friable consistency).	None	N/A	N/A	N/A
4	25-35 cm	Dark brown/blackish humic deposit (loose consistency).	None	10YR/5/2	7.5	Greyish brown
5	35-45 cm	Hard dark grey/brown humic deposit (firm to compact consistency).	None	10YR/4/1	6.5	Dark Grey
6	45-55 cm	Soft grey sand (loose to friable consistency). Disturbed by roots.	None	10YR/4/1	6.5	Dark Grey



Plate 34: DB-TP-05



Plate 35: Section View of DB-TP-05

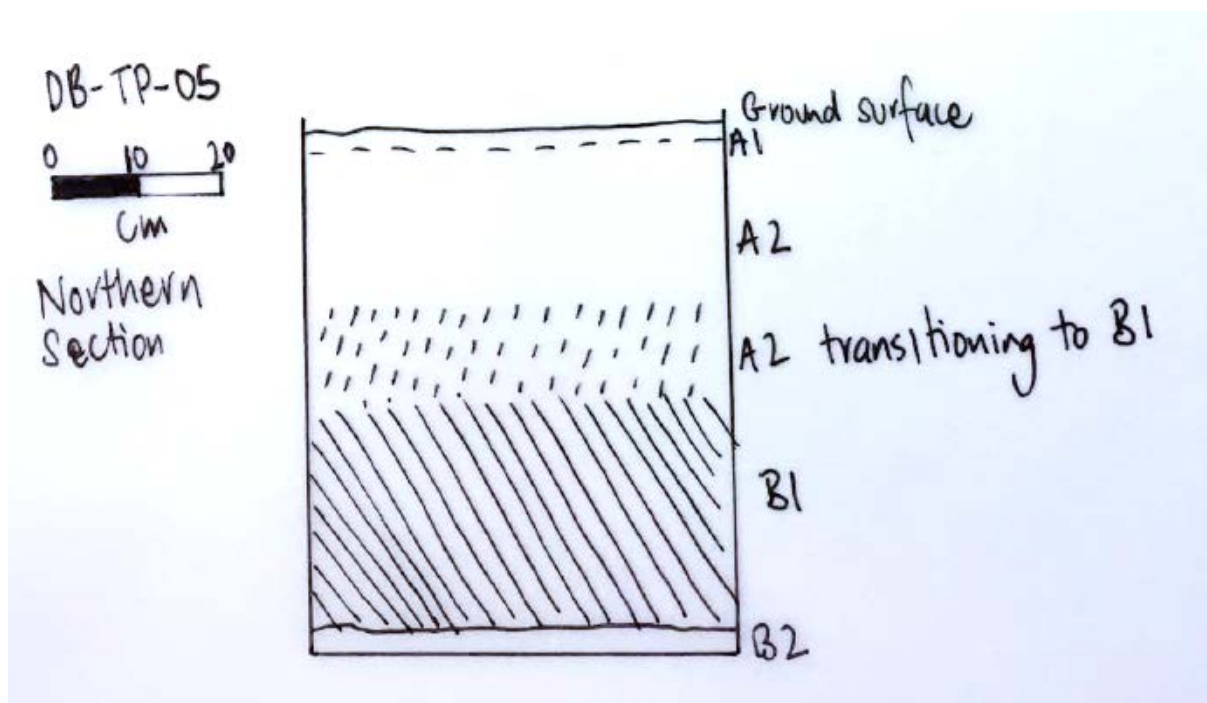


Plate 36: Section drawing DB-TP-05

Bottom of Dune Test Pit DT-TP-06

Table 32: Spit and soil descriptions for Test Pit 6

Spit	Depth	Description	Finds	Munsell Colour	pH	Soil Colour
1	0-5 cm	Soft clean sand (loose consistency). Disturbed by gravel fill.	None	10YR/8/6	7	Yellow
2	5-15 cm	Clean soft sand with small amounts of humic material (loose to friable consistency).	None	N/A	N/A	N/A
3	15-25 cm	Clean soft sand with small amounts of humic material increasing with depth (loose to friable consistency).	None	N/A	N/A	N/A
4	25-65 cm	Clean damp sand mixed with small amounts of humic material (loose to friable consistency). Disturbed by humic layer (mulch) at 650mm.	None	10YR/5/2	7.5	Greyish brown
5	65-75 cm	Dard brown humic deposit (firm to compact consistency).	None	10YR/4/1	6.5	Dark Grey



Plate 37: DB-TP-06



Plate 38: Section View of DB-TP-06

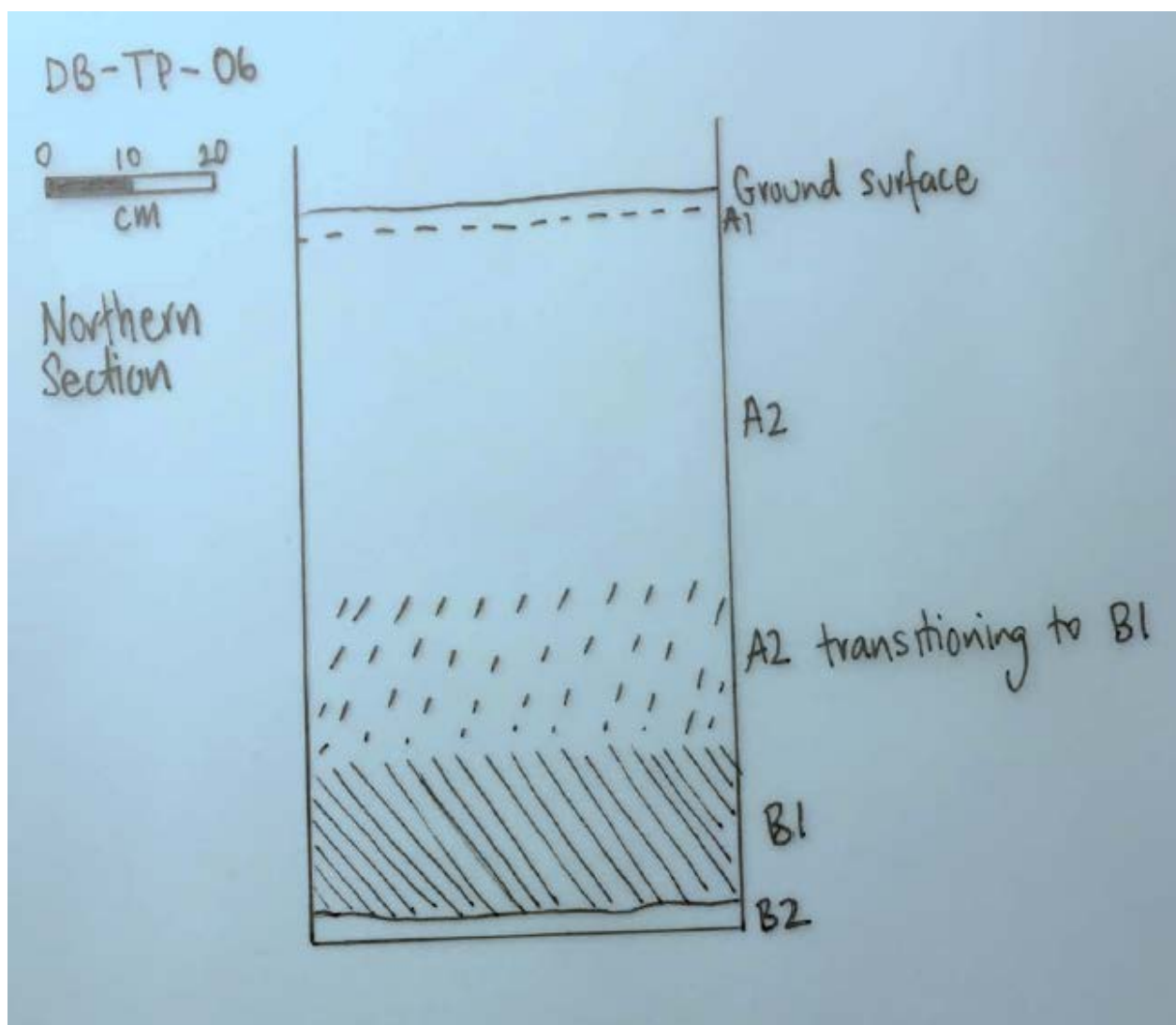


Plate 39: Section drawing DB-TP-06

Annex C: Due Diligence Assessment

12 March 2018

Ms Julie Wells
Tattersalls Lander Pty Ltd
Via email: julie@tatland.com.au

Dear Ms Wells,

Re: Aboriginal Heritage Assessment 4226 Nelson Bay Road, Anna Bay NSW

Thank you for inviting Niche Environment and Heritage (Niche) to complete a preliminary Aboriginal archaeological assessment for the proposed Anna Bay Sand Quarry. This short, letter-format report includes the results of the search of the Aboriginal Heritage Information Management System (AHIMS) administered by Office of Environment and Heritage (OEH), and the results of a field inspection.

The search of the AHIMS register was conducted on 18 January 2018 (AHIMS Client Service ID: 322781). The AHIMS search identified on Aboriginal site within the Subject Area, known as NBRd 4 (AHIMS ID#38-5-0320) comprising shell fragments on the surface, with the high possibility of the presence of more shell in the area as part of an extensive shell-midden. The AHIMS search identified another thirteen (13) Aboriginal sites within 1 kilometres of the Subject Area, including surface stone artefact scatters, shell middens including stone artefacts and potential archaeological deposits (PADs). The results of the AHIMS search are attached at the end of this document. Results of the search of the State Heritage Register (SHR), Australian Heritage Database and the Port Stevens Local Environmental Plan 2013 are provided in the Heritage Impact Assessment (Niche 2108).

The preliminary landscape assessment of the Subject Area identified a landscape feature which is identified as likely to indicate the presence of Aboriginal objects in accordance with Step 2c of the *Due Diligence Code of Practice for the Protection of Aboriginal Objects in New South Wales (DECCW 2010)*.

Traditionally, the Worimi people used the beaches to travel between Nelson Bay to the north and Stockton to the south, with Tilligerry Creek used as a route to the surrounding swamplands, creek lines and western areas. The area known as Stockton Bight has a special cultural significance to the Worimi people as it retains a large amount of cultural history. The land and waters have been used for thousands of years for the hunting and gathering of foods, fishing and the continuation of cultural, spiritual and sacred activities. Aboriginal cultural connections have always been strong in this area and continue today, as it is still a well-utilised fishing and recreational area used by today's Worimi people (MCH 2015).

A field assessment was completed by Viki Gordon (Senior Heritage Consultant), Jamie Merrick (Sites Officer Worimi Local Aboriginal Land Council), Lennie Anderson (Nu-Run-Gee Pty. Ltd.) and Rebecca Young (Mur-Roo-Ma Incorporated) on 23rd January 2018. The field assessment was undertaken to determine whether the project design would impact any Aboriginal objects.

Though the field assessment did not locate any surface Aboriginal objects it is the conclusion of the assessment that subsurface Aboriginal objects may be present and that further background research and inspection will need to be carried out. This conclusion is drawn due to:

- the close proximity to the proposed works to a number of Aboriginal sites (Figure 1) registered on the Office of Environment and Heritage (OEH) Aboriginal Heritage Information Management System (AHIMS),
- the presence of a sand dune system which has the potential to comprise Aboriginal objects,
- cultural information for Aboriginal representatives in relation to large shell middens in the general vicinity of the Subject Area,
- the relatively undisturbed nature of the vegetation,
- the close proximity of fresh water sources, and
- the undisturbed nature of the sand dune.

The above features, where relatively undisturbed, are identified in the Due Diligence Code of Practice for the protection of Aboriginal Objects in NSW as requiring further investigation and impact assessment if they cannot be avoided. Consequently, the recommendation is made that Tattersalls Lander Pty Ltd complete an Aboriginal Cultural Heritage Assessment with the possibility to apply for an Aboriginal Heritage Impact Permit (AHIP) under section 90 of the *National Parks and Wildlife Act 1974* as outlined in the Secretary's Environmental Assessment Requirements (SEARs) using the:

- DECCW (2010) *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW*
- DECCW (2010) *Aboriginal Cultural Heritage Consultation Requirements for Proponents*
- DECCW (2010) *Guide to investigation, assessing and reporting on Aboriginal cultural heritage in NSW*.

Please feel free to call or email should you wish to discuss anything further.

Yours sincerely

A handwritten signature in black ink, appearing to read 'R. Regal', with a stylized flourish at the end.

Renée Regal
Team Leader- Heritage
Niche Environment and Heritage

Bibliography:

McCardle Cultural Heritage Pty Limited 2015. MR 108 Nelson Bay Rd. Bobs Farm to Anna Bay Stage 3 – Cromarty Lane to Port Stephens Drive. Archaeological Salvage AHIP 1132063. Volume 1. A report to Roads and Maritime Services

Niche Environment and Heritage 2018. Anna Bay Sand Quarry 4226 Nelson Bay Rd, Anna Bay – Historical Heritage Impact statement. A report for Hay Enterprises (NSW) Pty Ltd.

Figure 1: Location of Aboriginal sites recorded on the AHIMS (Niche, AHIMS)



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

ATTACHMENT: RESULTS OF THE AHIMS SEARCH

Niche Environment and Heritage

Date: 18 January 2018

PO Box 3104

Umina Beach New South Wales 2257

Attention: Viki Gordon

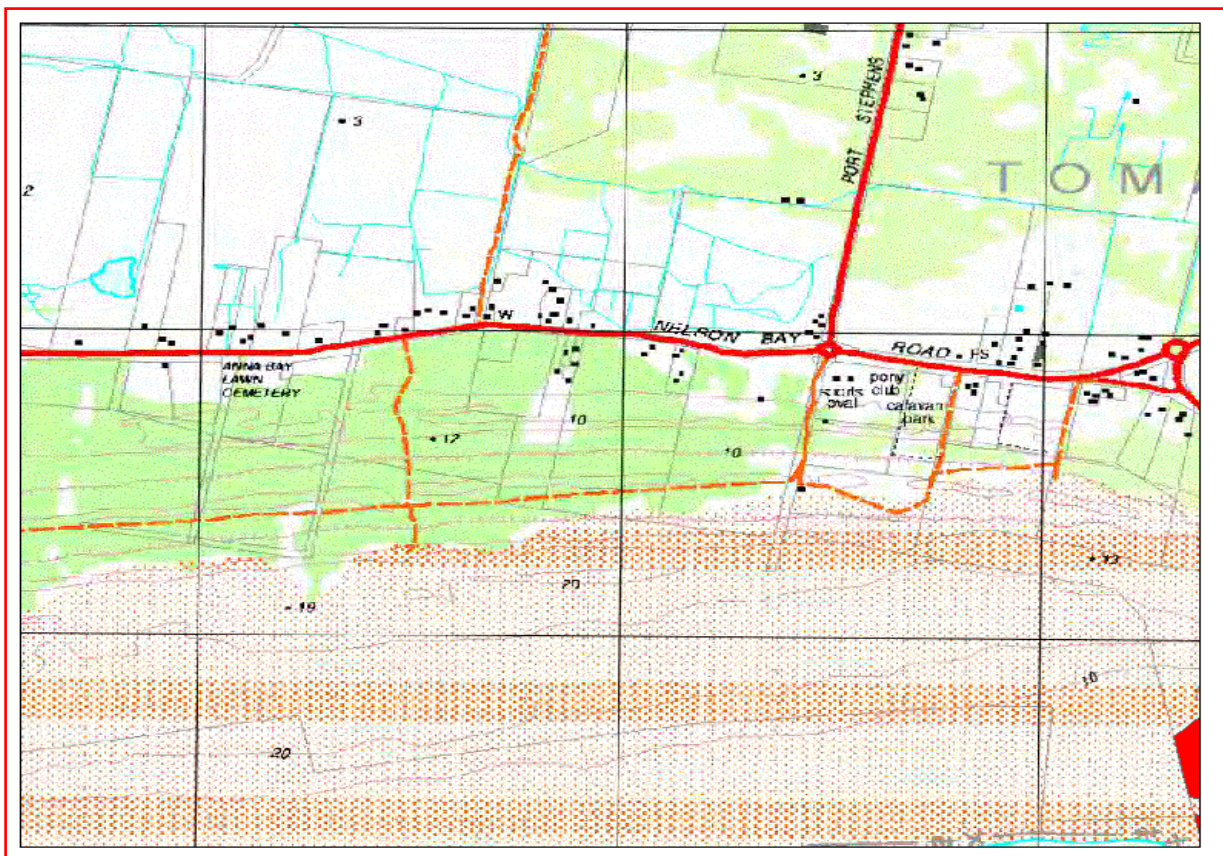
Email: vgordon@niche-eh.com

Dear Sir or Madam:

AHIMS Web Service search for the following area at Lot : 591, DP:DP1191380 with a Buffer of 1000 meters.

Additional Info : ACHA, conducted by Viki Gordon on 18 January 2018.

The context area of your search is shown in the map below. Please note that the map does not accurately display the exact boundaries of the search as defined in the paragraph above. The map is to be used for general reference purposes only.



A search of the Office of the Environment and Heritage AHIMS Web Services (Aboriginal Heritage Information Management System) has shown that:

14	Aboriginal sites are recorded in or near the above location.
0	Aboriginal places have been declared in or near the above location. *

If your search shows Aboriginal sites or places what should you do?

- You must do an extensive search if AHIMS has shown that there are Aboriginal sites or places recorded in the search area.
- If you are checking AHIMS as a part of your due diligence, refer to the next steps of the Due Diligence Code of practice.
- You can get further information about Aboriginal places by looking at the gazettal notice that declared it. Aboriginal places gazetted after 2001 are available on the [NSW Government Gazette \(http://www.nsw.gov.au/gazette\)](http://www.nsw.gov.au/gazette) website. Gazettal notices published prior to 2001 can be obtained from Office of Environment and Heritage's Aboriginal Heritage Information Unit upon request

Important information about your AHIMS search

- The information derived from the AHIMS search is only to be used for the purpose for which it was requested. It is not to be made available to the public.
- AHIMS records information about Aboriginal sites that have been provided to Office of Environment and Heritage and Aboriginal places that have been declared by the Minister;
- Information recorded on AHIMS may vary in its accuracy and may not be up to date. Location details are recorded as grid references and it is important to note that there may be errors or omissions in these recordings,
- Some parts of New South Wales have not been investigated in detail and there may be fewer records of Aboriginal sites in those areas. These areas may contain Aboriginal sites which are not recorded on AHIMS.
- Aboriginal objects are protected under the National Parks and Wildlife Act 1974 even if they are not recorded as a site on AHIMS.
- This search can form part of your due diligence and remains valid for 12 months.

Annex D: Aboriginal Heritage Impact Permit

Issue of Aboriginal Heritage Impact Permit

National Parks and Wildlife Act 1974



Planning,
Industry &
Environment

Your reference: AHIP Application for archaeological testing, 4226 Nelson Bay Road, ANNA BAY NSW 2316.
Our reference: AHIMS No. 4466 / EF19/16941
Notice number: C0004973
Contact: rog.hcc@environment.nsw.gov.au

Dr. Morgan Disspain – Project Manager
Senior Heritage Consultant
Niche Environmental and Heritage
HAY ENTERPRISES (NSW) PTY LTD
774 MARSH ROAD
BOBS FARM, NSW 2316

Attention

Dr. Morgan Disspain, mdisspain@niche-eh.com

Ms. Julie Wells, julie@tatland.com.au

Mr. Bob Lander, bob@tatland.com.au

NOTICE OF THE ISSUE OF

ABORIGINAL HERITAGE IMPACT PERMIT C0004974

Issued pursuant to section 90C (4) of the *National Parks and Wildlife Act 1974*

BACKGROUND

- A. Hay Enterprises NSW Pty Ltd (the applicant) applied to the Biodiversity and Conservation Division (BCD), of the Department of Planning, Industry and Environment (DPIE) (at the time of the application known as the Office of Environment and Heritage (OEH)), under section 90A of the *National Parks and Wildlife Act 1974* (NPW Act) for an Aboriginal Heritage Impact Permit (AHIP). The AHIP application was in relation to proposed Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP1191380, Anna Bay NSW 2316, in the Port Stephens Council Local Government Area.
- B. The project area contains an area of archaeological sensitivity, AHIMS site # 38-5-0347 (Anna Bay PAD-1) which would be impacted by the proposed activity.
- C. The applicant is seeking to determine the status of AHIMS Site # 38-5-0347 (Anna Bay PAD-1), and the nature and extent of the site prior to any development proposal being submitted to Port Stephens Council, as the determining authority.
- D. The received the application on 1 May 2019 and further information was received on 3 July 2017.

Issue of Aboriginal Heritage Impact Permit

National Parks and Wildlife Act 1974



Planning,
Industry &
Environment

ISSUE OF ABORIGINAL HERITAGE IMPACT PERMIT

1. BCD has considered the application and supporting information provided and matters under section 90K of the NPW Act and has decided to issue an AHIP **C0004974** subject to conditions.
2. The AHIP is attached.
3. You should read the AHIP carefully and ensure you comply with its conditions.

It is an offence under section 90J of the NPW Act to fail to comply with the conditions of the AHIP. The maximum penalty that a court may impose on a corporation for failing to comply with this AHIP is \$1,100,000.00. BCD can also issue penalty notices for this offence.

STEVEN COX

Senior Team Leader Planning

Hunter Central Coast Branch

Biodiversity and Conservation Division

Department of Planning, Industry and Environment

8 July 2019

INFORMATION ABOUT THIS NOTICE

- Details provided in this notice will be available on DPIE's Public Register in accordance with section 188F of the NPW Act.

Variation of this AHIP

- This AHIP may only be varied on application by the AHIP holder or by DPIE's to correct typographical errors or resolve inconsistencies between conditions of the AHIP. A permit can only be varied by subsequent variation notices.

Appeals against this decision

- You can appeal to the Land and Environment Court against this decision. The deadline for lodging the appeal is 21 days after you were given notice of this decision.

Aboriginal Heritage Impact Permit

Section 90 of the *National Parks and Wildlife Act 1974*



Planning,
Industry &
Environment

AHIP number: C0004974

(AHIMS Permit ID: 4466)

AHIP Issued To:

HAY ENTERPRISES (NSW) PTY LTD
74 MARSH ROAD
BOBS FARM NSW 2316

Attention

Dr. Morgan Disspain, mdisspain@niche-eh.com

Ms Julie Wells, julie@tatland.com.au

Mr. Bob Lander, bob@tatland.com.au

BCD Office issuing this AHIP

Biodiversity and Conservations Division

Department of Planning, Industry and Environment

Hunter Central Coast Branch

Locked Bag 1002

Dangar NSW 2309

Email: rog.hcc@environment.nsw.gov.au

Additional details for public register

a) Name of development or project	Anna Bay Sand Quarry 4226 Nelson Bay Road Lot 591 DP 1191380 ANNA BAY NSW 2316
b) Location	4226 Nelson Bay Road Lot 591 DP 1191380 ANNA BAY NSW 2316
c) Local Government Area(s)	Port Stephens
d) Description of harm authorised	Archaeological Test Excavations AHIMS Site # 38-5-0347 (Anna Bay PAD 1)
e) AHIP commencement date and duration	Commencement: 8 July 2019 Duration: 2 years

AHIP TO HARM ABORIGINAL OBJECTS

A. Background

- (i) On 1 May 2019, an application was made to the Biodiversity and Conservation Division (BCD), of the Department of Planning, Industry and Environment (DPIE) (at the time of the application known as the Office of Environment and Heritage (OEH)) for an Aboriginal Heritage Impact Permit (AHIP) pursuant to s.90 of the *National Parks and Wildlife Act 1974* (the Act).
- (ii) Hay Enterprises NSW Pty Ltd (the applicant) applied for an AHIP in relation to proposed Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP1191380, Anna Bay NSW 2316, in the Port Stephens Council Local Government Area.
- (iii) The project area contains an area of archaeological sensitivity, AHIMS site # 38-5-0347 (Anna Bay PAD-1) which would be impacted by the proposed activity.
- (iv) The applicant is seeking to determine the status of AHIMS Site # 38-5-0347 (Anna Bay PAD-1), and the nature and extent of the site prior to any development proposal being submitted to Port Stephens Council, as the determining authority.
- (v) OEH considered the application and supporting information provided and matters under section 90K of the Act and decided to issue an AHIP subject to conditions.

B. AHIP issued subject to conditions

An AHIP is issued to harm Aboriginal objects identified in Schedules B and C, in accordance with the conditions of this AHIP.

This AHIP is issued pursuant to section 90 of the Act.

C. Commencement and duration of AHIP

This AHIP commences on the date it is signed unless otherwise provided by this AHIP.

Unless otherwise revoked in writing, this AHIP remains in force for:

- (i) 2 years from the date of commencement, that is, until **8 July 2021**.

D. Proposed Works

The main components of the development proposal include:

- The extraction of sand to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.

The works will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the AHIP area.

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Note: A Dictionary at the end of the AHIP defines terms used in this document. Further information about this AHIP is also set out after the Dictionary.

STEVEN COX

Senior Team Leader Planning

Hunter Central Coast Branch

Biodiversity and Conservation Division

Department of Planning, Industry and Environment

5 July 2019

Aboriginal Heritage Impact Permit

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LAND TO WHICH THIS AHIP APPLIES

Figure (1)

The lands to which this AHIP applies - AHIP extent for Archaeological Test Excavations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316 (Page 12 of this AHIP).

Figure (2)

The lands to which this AHIP applies - Archaeological Test Excavation Locations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316 (Page 13 of this AHIP).

CONDITIONS

The conditions of this AHIP specify the actions that are permitted and/or required in relation to areas and Aboriginal objects, which are detailed in the Schedules that follow.

Administrative Conditions

Responsibility for compliance with conditions of AHIP

1. The AHIP holder must ensure that all persons involved in actions or works covered by this AHIP (whether employees, contractors, sub-contractors, agents or invitees) are made aware of and comply with the conditions of this AHIP.

Project manager to oversee the actions relating to this AHIP

2. A suitably qualified and experienced individual must be appointed as a project manager who is responsible for overseeing, for and on behalf of the AHIP holder, all the actions relating to this AHIP.
3. The individual appointed as project manager must be the project manager nominated in the application form.
4. If an alternative to the nominated project manager is appointed, BCD must be notified of their contact details within 14 days of this appointment.

Actions must be in accordance with AHIP application

5. All actions on the land must be carried out in accordance with the application except as otherwise expressly provided by a condition of this AHIP.

Operational Conditions

Certain Aboriginal objects must not be harmed

6. All human remains in, on or under the land must not be harmed.

Test excavations

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7. Test excavations may be carried out across the test excavation areas, as shown on Figure 2 The lands to which this AHIP applies - Archaeological Test Excavation Locations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316 (Page 13 of this AHIP)
8. Aboriginal objects that are recovered during the excavations may be analysed on-site and/or may be taken off-site for further analysis.
9. The excavations and analysis of Aboriginal objects must be carried out in accordance with the 'Anna Bay Sand Quarry, 4226 Nelson Bay Road, Anna Bay NSW, Aboriginal Cultural Heritage Assessment Report, Prepared for Tattersall Lander Pty Ltd, on Behalf of Hay Enterprises NSW Pty Ltd, Port Stephens Local Government Area, Consultancy: Niche Environment and Heritage, 15 March 2019' (OEHS CM9 DOC19/369954-2), that was provided with the application.
10. The excavations must be completed in an area before any harm of Aboriginal objects described in Schedule C can commence in that same area.

Harm of certain Aboriginal objects through the proposed works

11. The Aboriginal objects described in Schedule C may be harmed. Nothing in this condition authorised harm to Aboriginal objects described in Schedule A (whether human remains, Aboriginal objects or 'no-harm areas').
12. Aboriginal objects described in Schedule C must not be harmed unless:
 - (a) all excavations described in Schedule B2 have been completed in the area.

Temporary storage of certain Aboriginal objects

13. Any Aboriginal objects that are removed from the land by actions authorised by this AHIP, must be moved as soon as practicable to the temporary storage location in the table below, pending any agreement reached about the long-term management of the Aboriginal objects.
14. The temporary storage location is as follows:

Location name:	Niche Environment and Heritage Offices
Address:	Niche Environment and Heritage Offices Level 4 460 Church Street PARRAMATTA NSW 1750
Storage particulars:	In a secure locked cabinet.

15. Any Aboriginal objects stored at the temporary storage location must not be further harmed, except in accordance with the conditions of this AHIP.

Long term management of certain Aboriginal objects

16. Requirement 26 “Stone artefact deposition and storage” in the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (24 September 2010, available online at: <http://www.environment.nsw.gov.au/licences/archinvestigations.htm>) must be complied with.

Notification and Reporting Conditions

Notification of commencement and completion of actions

17. Written notice must be provided to the BCD office prior to the commencement of actions authorised by this AHIP. Written notice of commencement may be emailed to rog.hcc@environment.nsw.gov.au
18. Written notice must be provided to the BCD office within 7 days of the completion of actions authorised by this AHIP. Written notice of completion may be emailed to rog.hcc@environment.nsw.gov.au

Copy of this AHIP and notices to be provided to Registered Aboriginal Parties

19. A copy of this AHIP must be provided to each Registered Aboriginal Party, within 14 days of receipt of the AHIP from BCD.
20. Where this AHIP is varied or transferred, a copy of the AHIP variation or transfer notice must be provided to each Registered Aboriginal Party, within 14 days of receipt of the notice.

Human remains

21. If any human remains are discovered and/or harmed in, on or under the land, the AHIP holder must:
- (a) not further harm these remains
 - (b) immediately cease all work at the particular location
 - (c) secure the area so as to avoid further harm to the remains
 - (d) notify the local police and BCD’s Environment Line on 131 555 as soon as practicable and provide any available details of the remains and their location, and
 - (e) not recommence any work at the particular location unless authorised in writing by BCD.

Incidents which may breach the Act or AHIP

22. The AHIP holder must notify the BCD office in writing as soon as practicable after becoming aware of:
- (a) any contravention of s.86 of the Act not authorised by an AHIP, and/or
 - (b) any contravention of the conditions of this AHIP.

Reports about incidents which may breach the Act or AHIP

23. Where BCD suspects that an incident has occurred which may have breached the Act or AHIP, BCD may request a written incident report, which includes the following:
- (a) the nature of the incident
 - (b) the actual or likely impact of the incident on Aboriginal objects and/or Aboriginal places

- (c) the nature and location of these Aboriginal objects and/or Aboriginal places, referring to and providing maps and photos where appropriate
- (d) any conditions of an AHIP which may have been breached, and
- (e) the measures which have been taken or will be taken to prevent a recurrence of the incident.

24. The incident report must be provided to the BCD office within the timeframe specified in the request.

Provision of Aboriginal Site Impact Recording Form

25. An Aboriginal Site Impact Recording Form must be completed and submitted to the AHIMS Registrar, for each AHIMS site identified in Schedules B and C, within 6 months of the completion of the actions authorised by this AHIP.

Note:

- (i) The Aboriginal Site Impact Recording Form can be found on the OEH website:

<http://www.environment.nsw.gov.au/licences/DECCAHIMSSiteRecordingForm.htm>

- (ii) Contact details for the AHIMS Registrar can be found on the DPIE website:

<http://www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm>

Report about harm to Aboriginal objects (Test Excavation Report)

26. A Test Excavation Report must be prepared in accordance with Requirement 11 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (24 September 2010, available online at: <http://www.environment.nsw.gov.au/licences/archinvestigations.htm>)

27. The Test Excavation Report must be submitted to the BCD office within 12 months of the completion of the test excavations.

28. A copy of the Test Excavation Report, including a summary of the report in plain English, must be sent by registered post to each Registered Aboriginal Party within 14 days of the report being submitted to DPIE.

General Conditions

Indemnity

29. The AHIP holder agrees to indemnify and keep indemnified, the Crown in right of NSW, the Minister administering the Act, the Secretary of DPIE, and their employees, agents and contractors, in the absence of any willful misconduct or negligence on their part, from and against all actions, demands, claims, proceedings, losses, damages, costs (including legal costs), charges or expenses suffered or incurred by them resulting from:

- (a) any damage or destruction to any real or personal property; and
- (b) injury suffered or sustained (including death) by any persons arising out of or in connection with any actions undertaken pursuant to this AHIP.

Release

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30. The AHIP holder agrees to release to the full extent permitted by law, the Crown in right of NSW, the Minister administering the Act, the Secretary of DPIE, and their employees, agents and contractors, in the absence of any willful misconduct or negligence on their part, from all suits, actions, demands and claims of every kind resulting from:
- (a) any damage or destruction to any real or personal property; and
 - (b) injury suffered or sustained (including death) by any persons arising from or in connection with any actions undertaken pursuant to this AHIP.

Written notice

- (c) Any requirement to provide written notice to the BCD office in this AHIP may be complied with by emailing notice to the BCD office's email address. The BCD office's contact details are specified at the front of this AHIP.

SCHEDULES

The following schedules identify the areas and Aboriginal objects that are subject to the conditions of this AHIP.

Schedule A: Aboriginal objects which must not be harmed

A1 Human remains

All human remains in, on or under the land must not be harmed, as specified by the conditions of this AHIP.

A2 Aboriginal objects that are identified on AHIMS

Not applicable

A3 No-harm areas

Not applicable

Schedule B: Aboriginal objects that may be harmed through the certain actions

B1 Movement only

Not applicable

B2 Test excavations

Test excavations may be carried out across the test excavation areas, as shown on Figure 2 The lands to which this AHIP applies - Archaeological Test Excavation Locations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316 (Page 13 of this AHIP) but only in accordance with the conditions of this AHIP.

Test excavation area comprises the following known Aboriginal objects, as identified on AHIMS (excluding any Aboriginal objects described in Schedule A):

Portion of Site (whole or part)	AHIMS Site ID	Site Feature	Site Name	Information access restriction? (Y/N)	Easting	Northing	Datum
Part	38-5-0347	PAD	Anna Bay PAD 1	No	412042	6373398	GDA

B3 Community collection

Not applicable

Schedule C: Aboriginal objects which may be harmed through the proposed works

The Aboriginal objects described in this schedule may be harmed, but only in accordance with the conditions of this AHIP (excluding any Aboriginal objects described in Schedule A).

C1 Harm of Aboriginal objects identified on AHIMS

Portion of Site (whole or part)	AHIMS Site ID	Site Feature	Site Name	Information access restriction? (Y/N)	Easting	Northing	Datum
Part	38-5-0347	PAD	Anna Bay PAD 1	No	412042	6373398	GDA

C2 Areas where harm of Aboriginal objects is authorised

Not applicable

Aboriginal Heritage Impact Permit

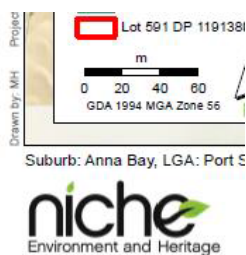
Section 90 of the *National Parks and Wildlife Act 1974*



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Figure (1)

The lands to which this AHIP applies - AHIP extent for Archaeological Test Excavations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316.



Aboriginal Heritage Impact Permit

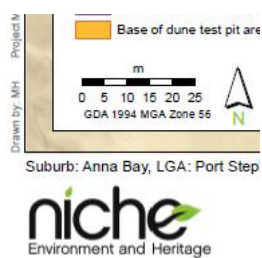
Section 90 of the *National Parks and Wildlife Act 1974*



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Figure (2)

The lands to which this AHIP applies - Archaeological Test Excavation Locations, Anna Bay Sand Quarry, 4226 Nelson Bay Road, Lot 591 DP 1191380, Anna Bay NSW 2316.



DICTIONARY

In this AHIP, unless the contrary is indicated the terms below have the following meanings:

Aboriginal object	has the same meaning as in the Act.
Act	means the <i>National Parks and Wildlife Act 1974</i> .
AHIMS	means the Aboriginal Heritage Information Management System maintained by DPC, as defined in s.90Q of the Act.
AHIP	means Aboriginal Heritage Impact Permit
AHIP holder	means the entity or person listed on the cover page under the heading "AHIP issued to".
Application	means the completed application form and all other documents in written or electronic form which accompanied the application when it was lodged or which were subsequently submitted in support of the application.
Community collection	means the collection of Aboriginal objects by one or all Registered Aboriginal Parties or their representatives.
Community collection area	means an area described as a community collection area in Schedule B3
Harm	has the same meaning as in the Act. In relation to Aboriginal objects, harm means the movement, damage, defacement and/or destruction of Aboriginal objects. In relation to an Aboriginal place, harm means the damage, defacement and/or destruction of the Aboriginal place.
Land	means the land described under the heading "Land to which this AHIP applies".
No-harm areas	means those areas described in Schedule A3.
OEH	Office of Environment and Heritage (NSW).
DPIE office	means the office listed on the cover page of this AHIP.
Proposed works	means the works described under the heading "D. Proposed Works" at the front of this AHIP.
Public register	means the public register established under s.188F of the Act, that contains details of AHIPs issued by the Secretary of DPIE, as described under the heading "Information about this AHIP".
Registered Aboriginal Parties	means the Registered Aboriginal Parties listed in the application.
Salvage excavation	means an archaeological excavation carried out in accordance with the methodology accompanying the application, as modified by the conditions of this AHIP. The purpose of salvage excavation is to recover a sample of Aboriginal objects as an archival record of Aboriginal life from a site that will be destroyed.
Salvage excavation area	means any area described as a salvage excavation area in Schedule B2.
Test excavation	means an archaeological excavation carried out in accordance with methodology accompanying the application, as modified by the conditions of this AHIP. The purpose of test excavation is to collect a

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sample of Aboriginal objects, in order to establish the nature and extent of sub-surface Aboriginal objects and to assist in the assessment of management options for the site.

Test excavation area means any area described as a test excavation area in Schedule B2

INFORMATION ABOUT THIS AHIP

Public Register

Under section 188F of the Act, the Secretary of DPIE is required to keep a public register containing the details of each AHIP issued. The details of this AHIP that will be published on the public register are outlined on the front page of this AHIP.

The public register is available online at www.environment.nsw.gov.au

Appeals

Under section 90L of the Act, the AHIP holder may appeal to the Land and Environment Court if they are dissatisfied with any condition of this AHIP. The appeal must be lodged within 21 days of the date this AHIP was issued.

Penalties for breach of the Act or AHIP condition

Significant penalties can be imposed by the Land and Environment Court for harm to an Aboriginal object or Aboriginal Place other than as authorised by a condition of an AHIP, or for a breach of an AHIP condition. DPIE can also issue penalty notices for a breach of the Act or AHIP condition.

Responsibility for obtaining all approvals and compliance with applicable laws

The AHIP holder is responsible for obtaining and complying with all approvals necessary to lawfully carry out the work referred to in this AHIP, including but not limited to development consents.

Other relevant provisions of the *National Parks and Wildlife Act*

Newly identified Aboriginal objects must be notified to the Secretary of DPC under s.89A of the Act using the form available online at www.environment.nsw.gov.au

Stop work orders, interim protection orders and remediation directions may be issued in certain circumstances to protect Aboriginal objects or places.

Obligation to report Aboriginal remains under Commonwealth laws

The AHIP holder may have additional obligations to report any discovery of Aboriginal remains under the *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*.

Exercise of investigation and compliance powers

Officers appointed or authorised under the Act may exercise certain powers and functions, including the power to enter land.

Duration of AHIP

This AHIP remains in force for the period specified in the AHIP.

Variation of AHIP

The AHIP holder may apply to the BCD office for a variation of any conditions of an AHIP, using the AHIP variation application form available online at www.environment.nsw.gov.au. Requests for significant variations must be accompanied by evidence of further consultation with Registered Aboriginal Parties and may include payment of fees.

The conditions of an AHIP may be varied at any time by the Secretary of DPIE in order to correct a typographical error or to resolve an inconsistency between conditions. The AHIP holder may appeal a decision of the Secretary of DPIE to vary the conditions of the AHIP.

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Transfer of AHIP

The AHIP holder may apply to transfer this AHIP to another person by using the AHIP transfer application form available online at www.environment.nsw.gov.au.

Surrender of AHIP

The AHIP holder may apply to surrender this AHIP by using the AHIP surrender application form available online at www.environment.nsw.gov.au. The surrender must be approved by the Secretary of DPIE and may be subject to conditions.

Suspension and revocation of AHIP

An AHIP may be suspended or revoked at any time at the discretion of the Secretary of DPIE. Prior to suspending or revoking the AHIP, the AHIP holder will be given notice and an opportunity to make submissions. The AHIP holder will be notified in writing of the final decision. The AHIP holder may appeal a decision to revoke the AHIP.

Entry to land

An AHIP does not automatically entitle its holder to enter land for the purpose of conducting work related to the AHIP. The AHIP holder is responsible for obtaining permission to enter land from the owner and/or occupier of the land.

Disclosure of information pursuant to lawful requirement

This AHIP does not prevent the disclosure of any information or document in DPIE's possession in accordance with any lawful requirement.

Making copies of reports

By providing a report, the AHIP holder acknowledges that DPIE can use the information in that report to inform its regulatory functions, note details of that report in AHIMS and include a copy of the report in its library which may be available to members of the public.

DPIE is able to make copies of any reports provided to DPIE under this AHIP.

Annex E: Aboriginal Site Impact Recording Form (Anna Bay PAD 1)

- 1 This form must be completed following impacts to AHIMS sites that are:
 - a) a result of test excavation carried out in accordance with the *Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW*
 - b) authorised by an Aboriginal Heritage Impact Permit (AHIP) issued by the Office of Environment and Heritage (OEH)
 - c) undertaken for the purpose of complying with Director General's Requirements issued by the Department of Planning and Infrastructure (DP&I) for:
 - State Significant Development (SSD - Part 4),
 - State Significant Infrastructure (SSI - Part 5.1), or
 - A Major Project (Part 3A - now repealed) under the *Environmental Planning and Assessment Act 1979* (EP&A Act), or
 - d) authorised by a SSD/SSI/Part 3A consent/approval under the EP&A Act.
- 2 Completed forms must be submitted to the AHIMS Registrar (www.environment.nsw.gov.au/contact/AHIMSRegistrar.htm).
- 3 This form is intended to complement (not replace) the AHIMS Site Recording Form. Where there is a need to provide detailed information about the nature of a site, use the AHIMS Site Recording Form.
- 4 This form does not replace the need to submit reports to OEH (as a condition of an AHIP or SSD/SSI/Part 3A consent/approval)
This form must be submitted in addition to any reports.

AHIMS site ID:

Date recorded:

Site impact authorisation (select one)	Reference numbers, dates
☐ Archaeological Code (The impacts to this site were the result of test excavation carried out in accordance with the <i>Code of Practice for the Archaeological Investigation of Aboriginal Objects in NSW</i> .)	Date OEH was notified (under requirement 15c of the Code): OEH Regional office notified:
☒ AHIP (The impacts to this site were authorised by an AHIP.)	AHIP number: C0004974 Date issued/signed: 2019-07-08 AHIMS permit ID/number: 4466
☐ SSD/SSI/Part 3A application (The impacts to this site were undertaken for the purposes of complying with Director General's Requirements issued by the DP&I)	Project number: Date Director General's Requirements issued:
☐ SSD/SSI/Part 3A approved project (The impacts to this site were authorised by a consent/approval under Parts 4/5.1/3A of the EP&A Act.)	or Date of project approval:

Site status following impacts:

- ☒ **Not a site** (The investigations concluded that this is not a site.)
- ☐ **Valid site** (The investigations confirmed that this is an Aboriginal site.)
- ☐ **Partially destroyed** (The site was partially destroyed following authorised impacts; a portion of the site remains in situ.)
- ☐ **Destroyed** (The site was completely destroyed following authorised impacts.)

Site Location Information:

Site name: Anna Bay PAD 1

Easting: 412042

Northing: 6373398

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m): 25

Zone: 56

Location method: Non-Differential GPS

Recorder Information:

(The person responsible for the completion and submission of this form)

Title

Surname

First name

Dr.

Disspain

Morgan

Organisation: Niche Environment and Heritage

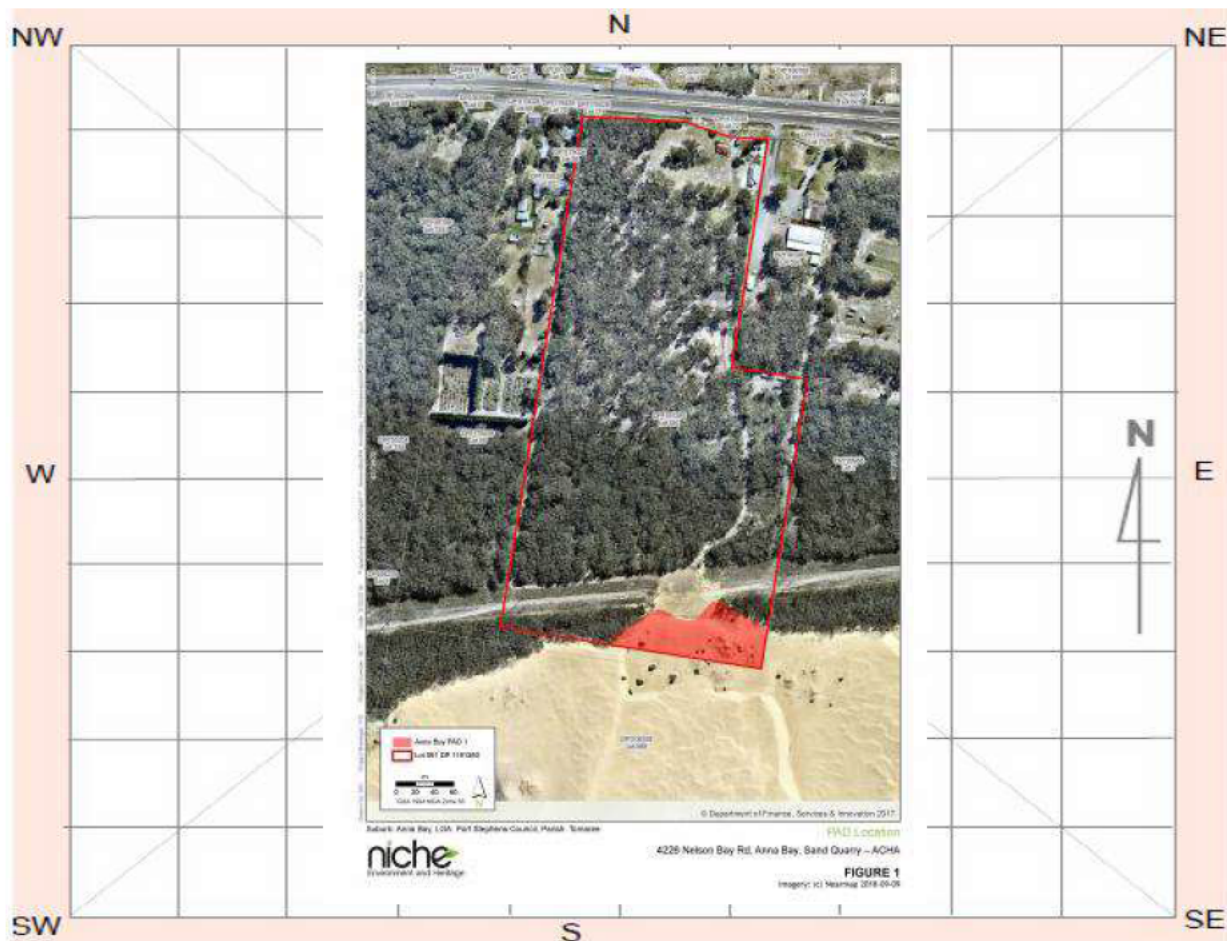
Address:

Phone: 0488774566

E-mail: mdisspain@niche-eh.com

Location map

Clearly demarcate the original AHIMS site boundary, show the boundaries of impacted areas and the areas where the site remains in situ. Display map coordinates.



Site contents information

open/closed site:

Open

Site condition:

Erosion

Features:

1.

Potential Archaeological Deposit

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

180

60

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar Length
(cm)

Scar Width
(cm)

Scar
shape

Tree
Species

Description:

PAD within a dynamic sand dune. Boundaries determined by subject area under assessment.

Features:

2.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar Length
(cm)

Scar Width
(cm)

Scar
shape

Tree
Species

Description:

Features:

3.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar Length
(cm)

Scar Width
(cm)

Scar
shape

Tree
Species

Description:

Features:

4.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar Length
(cm)

Scar Width
(cm)

Scar
shape

Tree
Species

Description:

Features:

5.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar Length
(cm)

Scar Width
(cm)

Scar
shape

Tree
Species

Description:

Other Site
Info:

Methodology and results

Summary of the methodology and results of the activity or works undertaken through the authorised impacts, as relevant to the AHIMS site

16 test pits measuring 50 x 50 cm were excavated across the PAD, both at the base of the dune, and along the crest. material was sieved through 3mm mesh. No Aboriginal Objects were identified.

Management recommendations

Summary of any management recommendations for the AHIMS site

Not a site

Post-investigation significance

Discuss if the scientific/archaeological or cultural significance of the site has changed in light of the results of the investigations or works conducted at the site.

Please refer to report (Niche Environment and Heritage 2019)

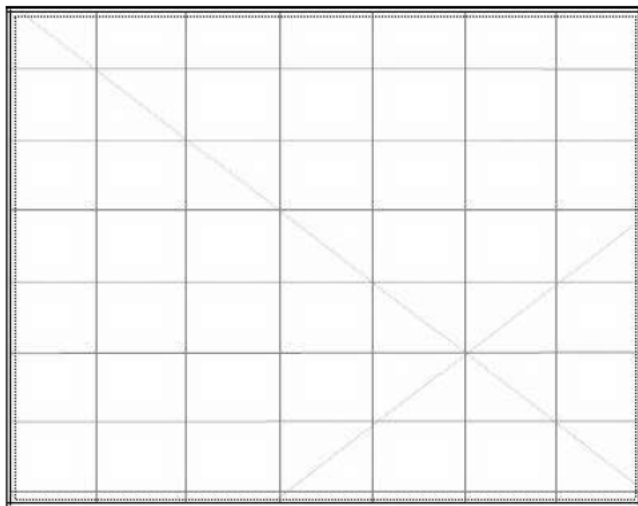
Additional comments

Site photographs

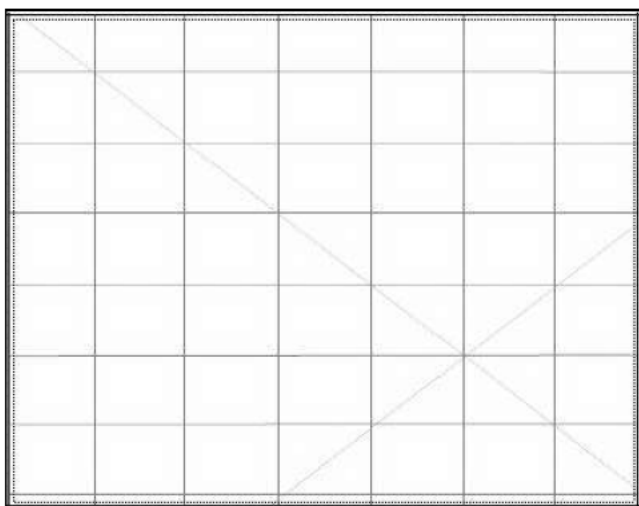
Include photographs of the authorised impacts activity, as relevant to the AHIMS site. Please keep photo size to a maximum of 200 kb.



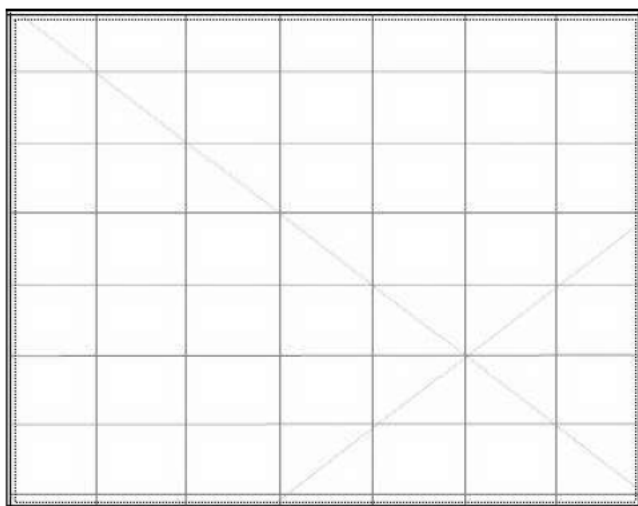
Description: Anna Bay PAD 1 facing west across dune face



Description:



Description:



Description:

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix B: Test Excavation Research Methodology



Anna Bay Sand Quarry

4226 Nelson Bay Road, Anna Bay NSW

**Aboriginal Heritage Impact Permit
Archaeological Testing Methodology**

Prepared for Tattersall Lander Pty Ltd on behalf of Hay Enterprises NSW Pty Ltd

Port Stephens Council Local Government Area

Author: Dr Morgan Disspain

25 February 2019

Document control

Project no.:	4017
Project client:	Tattersall Lander Pty Ltd
Project office:	NSW
Document description:	Aboriginal Heritage Impact Permit Archaeological Testing Methodology
Project Director:	Renée Regal
Project Manager:	Dr Morgan Disspain
Authors:	Dr Morgan Disspain
Internal review:	Clare Anderson
Document status:	Final
Local Government Area:	Port Stephens

Document revision status

Author	Revision number	Internal review	Date issued
Dr Morgan Disspain	Final	Clare Anderson	25 February 2019

Niche Environment and Heritage

Excellence in your environment.
ABN: 19 137 111 721

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Locations

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Central Coast
Illawarra
Armidale
Newcastle
Mudgee
Port Macquarie
Brisbane
Cairns

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Cover photograph: Looking east at proposed sand quarry area (Niche 2018)

Glossary and Abbreviations

Term	Definition
Aboriginal cultural heritage	The tangible (objects) and intangible (dreaming stories, legends and places) cultural practices and traditions associated with past and present day Aboriginal communities.
Aboriginal object(s)	The legal definition for material Aboriginal cultural heritage under the NSW <i>National Parks and Wildlife Act 1974</i> .
Aboriginal stakeholders	Members of a local Aboriginal land council, registered holders of Native Title, Aboriginal groups or other Aboriginal people who may have an interest in the Project.
Archaeology	The scientific study of human history, particularly the relics and cultural remains of the distant past.
Archaeological deposit	A layer of soil material containing archaeological remains.
Archaeological investigation	The process of assessing significance and potential of archaeological resources of a given impact area by a qualified archaeologist.
Archaeological site	A site with material evidence of past Aboriginal or non-Aboriginal activity in which material evidence (artefacts) of past activity is preserved.
AHIP	Aboriginal Heritage Impact Permit
Artefact	An object made by human agency (e.g. stone artefacts).
Assemblage	A group of stone artefacts found in close association with one another. Any group of items designated for analysis - without any assumptions of chronological or spatial relatedness.
Avoidance	A management strategy which protects Aboriginal sites within an impact area by avoiding them totally in development.
Catchment	The area from which a surface watercourse or a groundwater system derives its water.
Cumulative impacts	Combination of individual effects of the same kind due to multiple actions from various sources over time.
Development	The operations involved in preparing a mine for extraction, including cutting roadways and headings. Also includes tunnelling, sinking, crosscutting, drifting, and raising.
Drainage	Natural or artificial means for the interception and removal of surface or subsurface water.
Drape	A thin mobile layer of sediment that sits on the ground surface
Exposure	Exposure is different to visibility because it estimates the area with a likelihood of revealing buried artefacts or deposits rather than just being an observation of the amount of bare ground. It is the percentage of land for which erosion and exposure was sufficient to reveal archaeological evidence on the surface of the ground. Put another way, exposure refers to 'what reveals'.
Flake	A piece of stone detached from a core, displaying a bulb of percussion and striking platform.
Harm	With regard to Aboriginal objects this has the same meaning as the NSW <i>National Parks and Wildlife Act 1974</i> .
Impact	Influence or effect exerted by a project or other activity on the natural, built and community environment.
Impact area	An area that requires archaeological investigation and management assessment.
In situ	Latin words meaning 'on the spot, undisturbed'.

Term	Definition
Isolated find	A single artefact found in an isolated context.
Landscape character	The aggregate of built, natural and cultural aspects that make up an area and provide a sense of place. Includes all aspects of a tract of land – built, planted and natural topographical and ecological features.
Land unit	An area of common landform, and frequently with common geology, soils and vegetation types, occurring repeatedly at similar points in the landscape over a defined region. It is a constituent part of a land system.
Landform	Any one of the various features that make up the surface of the earth.
Management plans	Conservation plans which identify short and long term management strategies for all known sites recorded within a (usually approved) Project Area.
Methodology	The procedures used to undertake an archaeological investigation.
Mitigation	To address the problem of conflict between land use and site conservation.
OEH	Office of Environment and Heritage
Open camp site	An archaeological site situated within an open space (e.g. archaeological material located on a creek bank, in a forest, on a hill, etc.).
PAD	Potential archaeological deposit. A location considered to have a potential for subsurface archaeological material.
Site recording	The systematic process of collecting archaeological data for an archaeological investigation.
Site	In archaeological terminology a place where material evidence of past human activity is identifiable.
Survey coverage	A graphic and statistical representation of how much of an impact area was actually surveyed and therefore assessed.
Visibility	Visibility is the amount of bare ground (or visibility) on the exposures which might reveal artefacts or other archaeological materials. It is important to note that visibility, on its own, is not a reliable indicator of the detectability of buried archaeological material. Things like vegetation, plant or leaf litter, loose sand, stony ground or introduced materials will affect the visibility. Put another way, visibility refers to 'what conceals'.

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1. Introduction

1.1 Background

Niche Environment and Heritage (Niche) was commissioned by Tattersall Lander Pty Ltd, on behalf of Hay Enterprises NSW Pty Ltd, to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to facilitate the development of the Anna Bay Sand Quarry at 4226 Nelson Bay Road, Anna Bay (the Project), a designated development, under Part 4 of the NSW *Environmental Planning and Assessment Act, 1979* (EP&A Act). As a designated development, the Secretary's Environmental Assessment Requirements (SEAR 1172) require that an assessment of the potential impacts on Aboriginal heritage (cultural and archaeological) be undertaken. The assessment should include evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage.

The assessment to date has included background archaeological and historical investigation, ongoing consultation with the Registered Aboriginal Parties and an archaeological survey that included representatives from Mur-roo-ma Incorporated, Worimi Traditional Owners Indigenous Corporation, Karuah Indigenous Corporation, Worimi Local Aboriginal Land Council, and Nur-Run-Gee Pty Ltd.

The southern section of the Subject Area contains an area of high sensitivity within a sand dune system, which may be a continuation of a previously recorded site within the Subject Area, AHIMS ID#38-5-032. The area of sensitivity has been named Anna Bay PAD-1 (AHIMS ID#38-5-0347), which would be impacted by the proposed activity. The environmental context of the PAD, being an unconsolidated sand dune means that test excavation methodology under the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* [hereafter referred to as the 'Code of Practice'] is not suitable. As such, it is proposed to implement alternate excavation methods, as outlined in Section. 4.3. Owing to these factors, an AHIP is being sought from the Office of Environment and Heritage (OEH) to complete an archaeological testing program to test the area identified as Anna Bay PAD-1 (AHIMS ID#38-5-0347).

This methodology for the test excavation has been designed to conform to the relevant requirements of various advisory documents and guidelines. These guidelines and documents include:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH, 2011a).
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Part 6 National Parks and Wildlife Act, 1974)* (DECCW, 2010a).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) [hereafter referred to as the 'Code of Practice'].
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS], 1999).
- *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NSW National Parks and Wildlife Service, 1997).

1.2 Objective of community consultation

The objective of community consultation is for Aboriginal people to have the opportunity to improve assessment outcomes by:

- providing relevant information about the cultural significance and values of the Aboriginal object(s) and/or place(s);

- influencing the design of the method to assess cultural and scientific significance of Aboriginal object(s) and/or place(s);
- actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal object(s) and/or place(s) within the Subject Area; and
- commenting on the draft assessment report before it is submitted to government.

The following report is designed to inform the Registered Aboriginal Parties (RAPs) for the Project on the proposed subsurface archaeological investigation and provide them with the opportunity to comment on the methodology.

2. Project Information

2.1 The Project

The Proponent intends to establish the Anna Bay Sand Quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380).

This work will involve the excavation and relocation of sand, which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Tattersall Lander Pty Ltd, on behalf of Hay Enterprises NSW Pty Ltd, to consult with the Aboriginal community and to prepare:

- an Aboriginal Cultural Heritage Assessment (ACHA) Report and Archaeological Report (AR);
- management recommendations for any Aboriginal objects that might be identified during the process;
- an AHIP application to undertake archaeological test excavations; and
- a subsequent AHIP, should it be required, to manage any Aboriginal objects identified during the ACHA.

2.2 Where is the proposed project

The proposed Anna Bay Sand Quarry is situated at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380), within the coastal, semi-rural locality of Anna Bay, 12 km south west of Nelson Bay and 25 km north east of Newcastle Airport. It is situated within the Port Stephens region of NSW, in the Parish of Tomaree, in the County of Gloucester, and in the Port Stephens Council Local Government Area (Figure 1).

2.3 What is being proposed?

The main impacts of the development proposal (Figure 2) will be:

- The extraction of sand to ground level.
- Construction of a manager's residence/site office.
- Removal of vegetation for the purposes of the manager's residence/site office and associated bushfire asset protection zone (APZ)
- Site access upgrade at the intersection with Nelson Bay Road and minor site access improvements (haul road).
- Ancillary infrastructure.
-

This work will involve the excavation and relocation of sand which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

Drawn by: MH Project Manager: MD Project Number: 4017 Date: 2/25/2019 T:\spatial\projects\4000\4017_NelsonBayRd_AnnaBay_HA\Map\report\AHIP\4017_Figure_1_Location_AH.P mxd

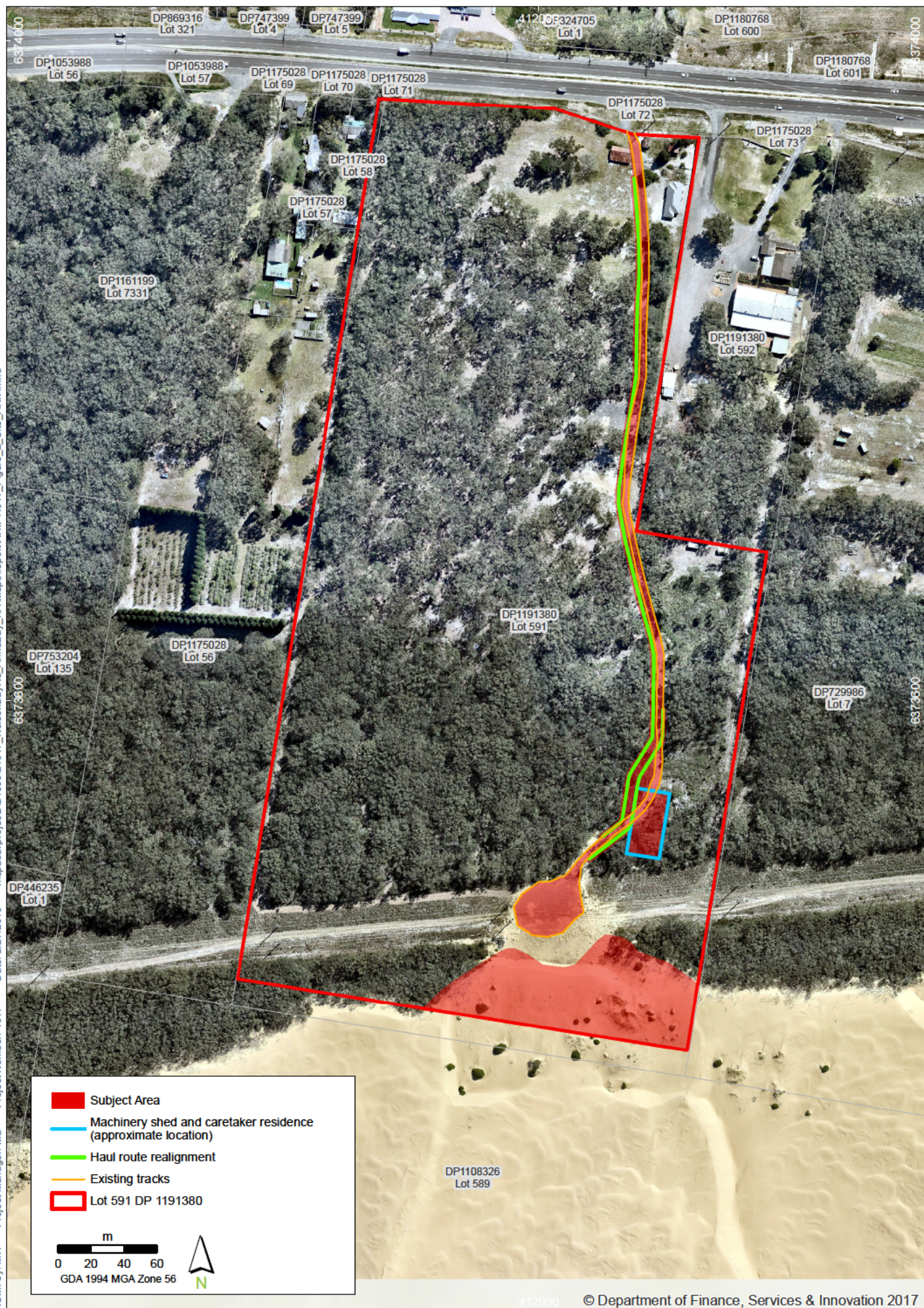


Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map

4017 Anna Bay Sand Quarry

FIGURE 1



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location of the Subject Area

4017 Anna Bay Sand Quarry

FIGURE 2

Imagery: (c) Nearmap 2018-09-09

3. Assessment to Date

The assessment to date has included background desktop research about the Subject Area and immediate surrounds, database searches for listed heritage places and previously recorded sites, and a site inspection, which was conducted on 11 October 2019. Detailed information about these assessments can be found in the Aboriginal Cultural Heritage Assessment Report (ACHAR) for this project (Niche 2019). The below information provides a brief summary of previously recorded sites within, and within proximity to the Subject Area.

3.4 Previously recorded sites

An extensive Aboriginal Heritage Information Management System (AHIMS) search was conducted on 18 January 2018 (AHIMS Client ID: 322781), centred on the Subject Area (Figure 3).

The AHIMS search identified one Aboriginal site within the Subject Area, known as NBRd 4 (AHIMS ID# 385-0320). The site comprises shell fragments on the ground surface, with the high possibility of the presence of more shell in the area as part of an extensive shell-midden. Thirteen (13) additional Aboriginal sites were located outside the Subject Area within a 1 km distance, including surface stone artefact scatters, shell middens with stone artefacts, and potential archaeological deposits (PADs). The AHIMS sites are summarised in Table 1.

Table 1: Previously recorded AHIMS sites within 1 km of the Subject Area

AHIMS No.	Site Features
38-5-0121	Artefacts and shell
38-5-0198	Artefact
38-5-0223	Artefact and shell
38-5-0250	Artefacts and shell
38-5-0320	Shell
38-5-0321	Shell
38-5-0319	Shell
38-5-0312	Artefact
38-5-0310	Artefact and shell
38-5-0311	Potential Archaeological Deposit (PAD)
38-5-0327	Artefact
38-5-0324	Potential Archaeological Deposit (PAD)
38-5-0325	Potential Archaeological Deposit (PAD)
38-5-0331	Artefact

3.4.1 Sites within the Subject Area

The previously recorded Aboriginal site (NBRd 4 AHIMS ID#38-5-0320) was relocated in the northern part of the property during the site inspection. The site will not be impacted by the proposed haul road, as the section in close vicinity to the site has been already built and there are no significant modifications proposed for this road.

During the site survey, one area of archaeological potential was identified within the Subject Area — Anna Bay PAD 1 (AHIMS ID 38-5-0347) (Table 2). This was defined as the immediate vicinity and foreground of the sand dunes in the southern section of the property (Figure 4).

Table 2: Details of the previously and newly recorded Aboriginal sites within the Subject Area

Site name and number	Site Features	Easting	Northing
NBRd 4 (AHIMS ID #3850320)	Shell, Potential Archaeological Deposit	412046	6373942
Anna Bay PAD 1 (AHIMS ID 38-5-0347)	Potential Archaeological Deposit	412042	6373398

3.4.2 Other heritage registers

Searches of numerous heritage databases, as well as the Port Stephens Local Environmental Plan (LEP) and Port Stephens Development Control Plan (DCP), were undertaken by Niche on 31 January, 2018.

No listed heritage items are located within the Subject Area (Table 3); however, a number of heritage items are located nearby. Further consideration of historic heritage items is provided in a separate Heritage Impact Assessment (Niche Environment and Heritage, 2018a).

Table 3: Heritage registers search results

Heritage Registers	Heritage Items in the Subject Area	Nearby Heritage Items
World Heritage List	None	None
National Heritage List	None	None
Commonwealth Heritage List	None	None
State Heritage Register	None	Birubi Point Aboriginal Place
State Heritage Inventory	None	Birubi Point Cemetery (Item ID: I2)
Local Environmental Plans	None	Stockton Beach Dune System (Item ID: I34)
Development Control Plans	None	DCP Controls apply to the above heritage items.

3.4.2.1 Birubi Aboriginal Place

Birubi Point, which is located 1.4 km the east of the Subject Area, is a registered Aboriginal Place due to its continued association with the Worimi people. It was registered as an Aboriginal Place 5062849 (file number 07/18962 & DOC 07/50249 & DOC1) under the NPW Act in 2007. It is a traditional Aboriginal ceremonial and burial site, which contains extensive archaeological material considered important to the teaching of the current and future generations about the local Aboriginal culture. This site is connected with the Worimi Conservation Lands, which are a joint management of a number of National parks and conservation areas. This place provides valuable information regarding the archaeological potential of the Subject Area due to its proximity and context.

3.4.2.2 Birubi Point Cemetery

Birubi Point Cemetery is located approximately 2.3 km from the Subject Area. Birubi Point Cemetery was in use between 1876 and 1996 and contains the graves of early settlers to the area, as well as shipwrecked persons, some of who were unidentified. The cemetery is located adjacent to the original lot of land settled by the Blanch family in the 1950s. The point on which the cemetery is located was known as Cemetery

Point, until the name was officially changed in 1976; it is now located within the lands of the Birubi Point Aboriginal Place. The first internment in 1876 was that of Lucy Blanch who was an Anna Bay pioneer. The cemetery contains a layout plan on a plaque and includes a list of all the known burials within the cemetery, numbering 88 internments.

3.4.2.3 Stockton Beach Dune System

Stockton Beach dune system is the largest moving coastal land mass in the southern hemisphere, and stretches from Stockton to Anna Bay covering a distance of approximately 25 kilometres in length. According to the Register of the National Estate, the entire bight (stretching from the Hunter River Estuary to Birubi Point in the north) is of significance for its unique natural ecosystem (RNE Place ID: 19510).

As a result of the shifting sand sheet, Aboriginal midden sites, burials and education sites important to the Worimi peoples, as well as World War II fortifications, are periodically covered and revealed by the moving sands. These sand dunes are directly adjacent to the Subject Area, and are encroaching northwards from the southern boundary of the Subject Area. Their dynamic nature means that archaeological material may exist within the Subject Area subsurface.

3.1 Archaeological survey

The archaeological survey of the Subject Area was carried out on the 11 October, 2018. Details of the participants are provided in **Error! Reference source not found.** below.

Table 4: Details of field survey participants in alphabetical order

Name	Organisation
Lennie Anderson	Nur-Run-Gee Pty Ltd
Dave Feeney	Karuah Indigenous Corporation
Balazs Hansel	Niche
Jamie Merrick	Worimi Local Aboriginal Land Council
Candy Towers	Worimi Traditional Owners Indigenous Corporation
Tom Towers	Worimi Traditional Owners Indigenous Corporation
Bec Young	Mur-roo-ma Incorporated

The field survey covered the entire Subject Area with an additional buffer around the entire extent of the proposed impact footprint including the manager's residence/site office as well as the sand quarry.

The previously recorded Aboriginal site NBRd 4 (AHIMS ID#38-5-0320) was relocated in the northern part of the property. The site will not be impacted by the proposed haul road, as the section in close vicinity to the site has been already built and there are no significant modifications proposed for this road.

No additional Aboriginal sites were identified; however, the survey identified an area of archaeological potential within the immediate vicinity and foreground of the sand dunes in the southern section of the property.

This PAD was subsequently registered (Anna Bay PAD 1 (AHIMS ID 38-5-0347)), and the survey results recommended further investigation in the form of test excavation to increase archaeological exposure and visibility and to test the potential of the landform for archaeological resources.

3.2 Predictive Model

Predictive modelling has been developed for the area utilising data from the archaeological, geological and geomorphic research presented in the ACHAR. Previous archaeological studies undertaken throughout the area provide a good indication of site types and site patterning in the area. These studies have shown that shell middens associated with stone artefacts and middens with only shell fragments are the most predominate site types within the area. The most common site location is the seaward area of active transgressive dunes/ active blowout. This is then followed by the beach fore dune and outer basin (Eric Martin and Associates, 2002:34). The Subject Area lies in the Outer Holocene barrier and sand dunes.

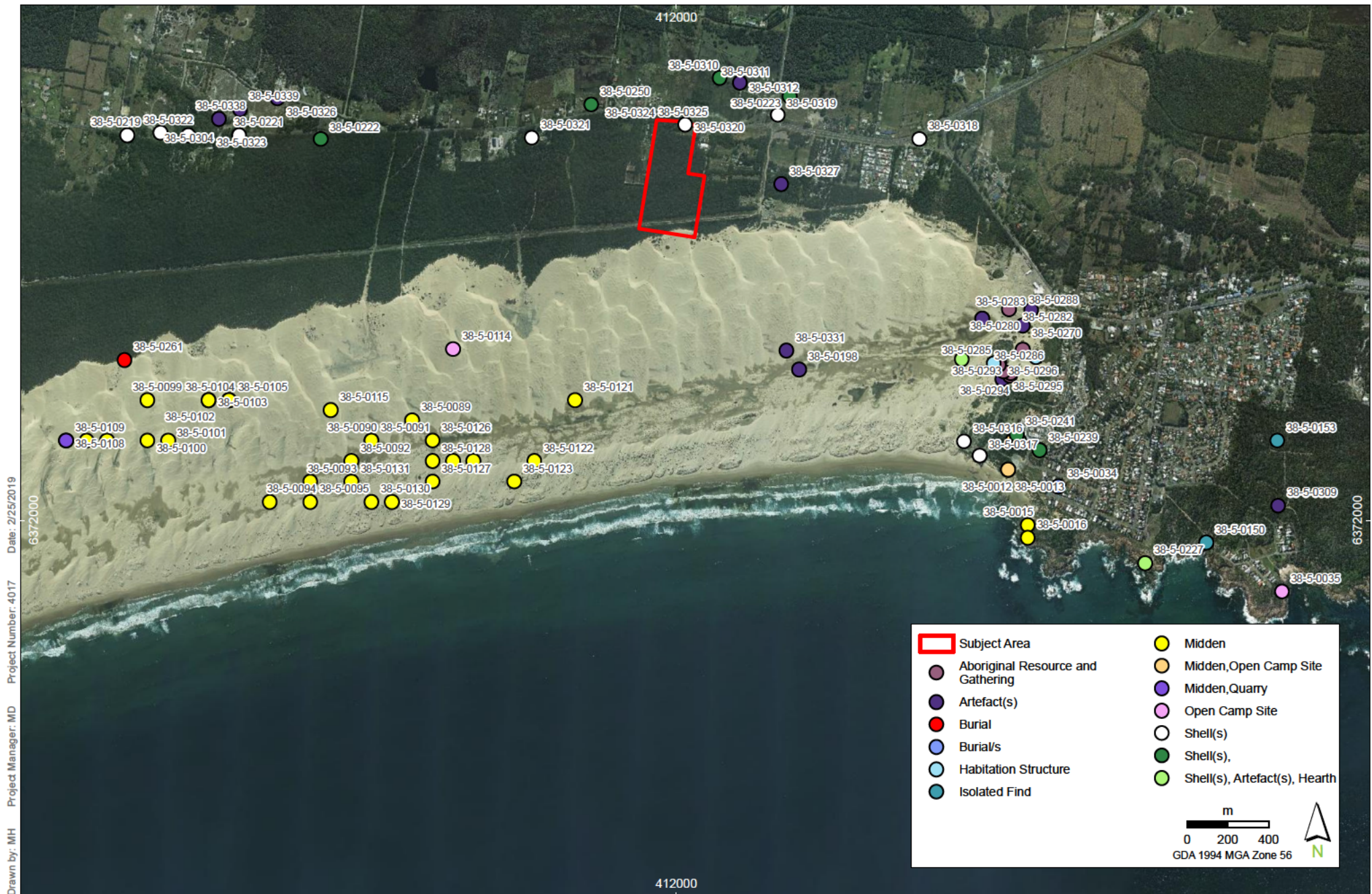
The general predictions and key trends are listed below:

- The most common site types are open sites containing shell with artefacts, followed by isolated finds.
- Sites are usually located within 50 metres of reliable water source.
- Sites are located both on the Holocene and Pleistocene dunes overlooking the interbarrier depression.
- Sites are not usually found in the interbarrier depression.
- Site types are predominately shell middens, stone tools and may also contain charcoal.
- Artefact scatters, isolated finds, scarred trees, burials and ceremonial sites may also be found along the dunes.
- Larger sites with higher densities of artefacts are more likely to be found close to stream confluences and permanent water sources, such as Tillegerry Creek (approximately two kilometres from the Subject Area).
- Artefacts typically date to the Holocene.
- Both middens (including estuarine shell species, rock oysters and mud whelk) and open camp sites are located on the inner landward margin of the Holocene dunes.
- Stone artefact types include flakes, flaked pieces, broken flakes, cores and tools.
- Artefact scatters are most commonly linked in close proximity to permanent water sources including creeks, swamps, the inter barrier depression and the coast.
- Frequency and density of artefacts are directly related to location within the landscape.
- Large sites increase markedly with proximity to permanent water sources.
- The majority of sites will be subject to disturbances including human and natural.
- High concentrations of artefacts are more likely to be located within resource rich areas.

A site specific predictive model was developed and is described below. This predictive model has been developed based on a review of landscape context and individual landforms, ethno historical evidence of traditional land use, distribution of natural resources, the results of previous archaeological work in the vicinity of the study area and the predictive modelling proposed in previous investigations.

- Shell artefacts and stone artefacts will be the most common site type across the landscape and are the most likely site type to occur within Anna Bay PAD 1.
- The unconsolidated sand at the top of the dune is predicted to have lower archaeological integrity owing to the mobility of the dunes, than the stable sediment at the base of the dune, which has a higher likelihood of containing in situ archaeological deposits.
- Sites will most commonly be low density artefact scatters or isolated finds, although high density scatters may also be present.
- Relatively undisturbed soils have potential to contain subsurface archaeological deposits.

- Excavations within the region suggest that high densities of artefacts are present around 50 m from water sources, and that subsurface material may be much greater than indicated by surface numbers of artefacts. Densities of artefacts are likely to be lower within Anna Bay PAD 1 due to its distance from water sources.
- Given the environmental context of the sand dunes, and the proximity to Birubi Aboriginal Burial Ground, it is possible that burials may occur in the sand dunes though such an occurrence would be rare. Burial sites can occur anywhere but generally in significant landform locations and generally in soft soils.
- The following site types are **unlikely** to occur in Anna Bay PAD 1:
 - Stone quarry sites, axe grinding grooves, stone engravings/art and shelter sites due to the lack of suitable geology.
 - Scarred or carved trees due to the extent of vegetation clearing in the region.



Aboriginal sites in the surrounding Area

4017 Anna Bay Sand Quarry

FIGURE 3

4. Proposed Methodology for Cultural Heritage Assessment

4.1 Aboriginal Cultural Heritage Assessment (ACHA) and AHIP Test excavation

The ACHA will follow and draw on where relevant the guidelines set out in the:

- *Aboriginal cultural heritage consultation requirements for proponents 2010*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales.*

The ACHA will aim to:

- Synthesise the results of technical investigations, the significance of the finds made, make management recommendations on requirements for additional approvals including the testing AHIP and possible development AHIP, should it be required.
- Incorporate the process and results of consultation, undertaken in compliance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* guidelines.

The ACHA will follow the broad program outlined below:

- **Desktop assessment** - Much of this work has already been completed by Niche. This work will continue up until the finalisation of the draft ACHA for submission to the RAPs for comment.
- **Survey** - A survey was undertaken in October 2018 in consultation with RAPs. During this survey, the Anna Bay PAD 1 (AHIMS ID 38-5-0347) was identified and recorded.
- **Reporting** - A draft report that satisfies the requirements of the *Office of Environment and Heritage Archaeological Code of Practice, the Consultation Requirements for Proponents* and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW 2011* will be prepared to support an AHIP application to allow investigative works in the subject area in mid- 2019.
- **AHIP Application** – An AHIP application to conduct archaeological test excavations will be submitted to OEH.
- **Archaeological test excavation program** - Following the approval of an AHIP for testing, an archaeological testing program would be undertaken. The archaeological testing program is outlined in Section 4.3. Once testing has been completed, any artefacts recovered from the testing program would be analysed and the draft ACHA/AR would be prepared.
- **Reporting** – The ACHA and AR would be updated to include details of the archaeological testing program and further mitigation and management recommendations as required. There may be a requirement at this stage for a further AHIP application for quarrying of sand material.

4.2 Aboriginal community input points for the assessment

The guidelines suggest several points of input for RAPs, including:

- (1) during project information presentation
- (2) during development of the methodology
- (3) during meetings / site inspections / fieldwork (i.e. at any time during the process)
- (4) during review of the draft cultural heritage report

Points one, two, and three have been undertaken for the present report.

4.3 Archaeological and Cultural Heritage AHIP Test Excavation

The purpose of this section is to describe the method that will be used to conduct archaeological test excavation of the area identified as having potential for archaeological deposits (PAD). The area of sensitivity has been named Anna Bay PAD-1 (AHIMS ID#38-5-0347) (Figure 4) and would be impacted by the proposed sand extraction. The aim of the test excavation will be to provide further information on the presence, nature, significance and extent of sub-surface archaeological deposit within the Subject Area, and the Aboriginal archaeological values of the Subject Area.

The environmental context of the PAD, being an unconsolidated sand dune, means that test excavation methodology suitable for the unstable landform does not follow the conditions and methodology set out in the Code of Practice. As such, it is proposed to implement alternate excavation methods, as outlined in Section. 4.3. Owing to these factors, an AHIP is being sought from the OEI to complete an archaeological testing program to test the area identified as Anna Bay PAD-1 (AHIMS ID#38-5-0347).

4.3.1 Research questions

The primary purpose of conducting archaeological test excavations at Anna Bay PAD 1 is to add to our knowledge of the distribution of cultural material within the Subject Area, and to develop appropriate management strategies for implementation during future works. In doing so, we hope to add important information to the 'story' of Aboriginal occupation of these lands. The intention of the proposed archaeological investigation is not just to collect as many artefacts as possible, but rather to obtain a better understanding of the distribution of archaeological and cultural heritage materials across the Subject Area.

Because of this unknown archaeological potential within the PAD, the following high level research questions will be used to structure and guide the ACHA, particularly the investigation AHIP:

- What is the presence, absence or likelihood of occurrence of Aboriginal objects?
- If present or likely, what is the scope and integrity of an identified archaeological profile?
- If present, what is the age of deposition and significance of the Aboriginal objects?

Should Aboriginal objects be found to be present, the research questions will be revisited and reconsidered and new research questions that interact with and derive from what has been found in the investigation AHIP will be formulated and used to guide any future archaeological works that may be required.

4.3.2 Consultation on the methodology

The methodology for the test excavation was sent to the RAPs during the consultation process, and a copy of feedback is included in Appendix B of the ACHAR – Community Consultation.

4.4 Sampling Strategy

The test excavations would target Anna Bay PAD 1, as it would be directly impacted by the proposed development, and has been assessed as having the potential to contain Aboriginal artefacts. The proposed quarry would remove all of the sand within the PAD to ground level, destroying any in situ Aboriginal sites. The remainder of the Subject Area will either not be impacted during the proposed project, or has been disturbed to an extent where the likelihood of Aboriginal artefacts existing is significantly lower than the Anna Bay PAD 1.

10–20 non-stratigraphic shovel test pits would be excavated along the top of the sand dune, within the impact footprint and AHIP area. The purpose of these trenches would be to:

- identify the presence or absence of Aboriginal objects within the highly dynamic area of the sand dune; and
- collect soil samples for pH test, and munsell colour determination.

Additionally, 10–20 stratigraphic trenches measuring 50 cm x 50 cm would be excavated by hand at the base of the dune, within the AHIP area. The purpose of the test pits will be to:

- Establish the stratigraphy of potential subsurface deposits.
- Identify the presence or absence of Aboriginal objects.
- Collect radiocarbon dating samples, if present.
- Collect soil samples.
- Assist in the identification of archaeologically sterile unit should that occur within the impact footprint.

It is anticipated that a maximum of 20 m² would be excavated during the test excavations. This is less than 0.3% of the total area of Anna Bay PAD 1, being 6793 m². Expansion test pits, triggered by the criteria in Section 4.4.3 would be limited to an additional 40 m².

4.4.3 Method

It would be very difficult to test the sand body within Anna Bay PAD 1 using traditional methods without a significant safety risk due to the very loose nature of the sand. Owing to this, it is proposed to use two different methods of excavation within the PAD.

On top of the sand dune, where the sand is extremely loose and soft, test excavations would:

- Be carried out using a shovel to dig test pits measuring approximately 50 cm x 50 cm over a 5 m x 5 m grid. Figure 5 depicts an estimated positioning of the grid system; however, the field team reserves the right to alter this placement based on on-the-ground observations of best placement at the time of the test excavation program. The exact locations will be determined by the Excavation Director, based on advice of the Heritage Consultant and Registered Aboriginal Parties.
- Test Pits will be hand excavated
- Excavation would cease:
 - Where it would be considered that digging any deeper would be unsafe without the aid of benching or shoring;
 - at the base of artefact bearing layers;
 - at a viable B horizon indicating a base of artefact layer;
 - at rock, should this occur in the absence of B horizon or base of artefact layer;
 - at groundwater, where present; or
 - where sufficient information has been recovered to understand the extent, nature and significance of the archaeological deposit, if any.
- All excavated material will be dry sieved through 3 mm mesh screens. It is anticipated that these test pits will not be dug in controlled spits, owing to the unconsolidated nature of the sediment profile.
- Photographic recording of each hole will be taken, as well as GPS locations.

The proposed test excavation methodology for the stable ground surface at the base of the sand dune is outlined below:

- Test excavation pits would measure 50 cm x 50 cm and would be laid out over a 10 m x 10 m grid. Figure 5 depicts an estimated positioning of the grid system; however, the field team reserves the right to alter this placement within the AHIP area based on on-the-ground observations of best placement at

the time of the test excavation program. The exact locations will be determined by the Excavation Director, based on advice of the Heritage Consultant and Registered Aboriginal Parties. These locations may be subject to change as further information becomes available.

- The excavation pits will be hand excavated.
- Excavation would be carried out using 5 cm spits for the first test pit within each transect, and 10 cm spits for each test pit thereafter to:
 - the base of artefact bearing layers;
 - a viable B horizon indicating a base of artefact layer;
 - rock, should this occur in the absence of B horizon or base of artefact layer;
 - groundwater, where present;
 - where it would be considered that digging any deeper would be unsafe; or
 - where sufficient information has been recovered to understand the extent, nature and significance of the archaeological deposits
- Where necessary, test excavation pits would be expanded using 50 cm x 50 cm pits to document archaeological features or areas of relatively high artefact density. These areas will not exceed 3 m² in surface area.
- All excavated material will be weighed prior to sieving to allow for the provision of proportional weights for analysis of shell or faunal bone if it is identified within the PAD.
- All excavated material will be dry sieved through 3 mm mesh.
- Soil will be retained for backfilling of test pits.
- All excavation units (spits, contexts, stratigraphic units etc.) will be assigned a unique identifier.
- If specific archaeological features such as hearths are identified the feature will be excavated stratigraphically and be photographed and drawn.
- Photographic recording of each pit and spit as well as large scale photos of transects will be taken.
- Scaled drawings of one section of each test pit will be completed.
- Non-differential GPS readings will be taken at each test pit location.

Expansion of test pits is not anticipated to be required; however, the following guide will be used to assist decision making if finds of particular interest are encountered, and if test pit expansion is warranted:

- In no case will test pits expand beyond the impact footprint.
- Discovery of relative density of artefact frequencies that in the opinion of the archaeologist, are unusually high.
- Discovery of unusual or rare raw materials, artefact types or classes that, in the opinion of the archaeologist, are likely to be especially informative for the assessment of value and significance.
- Discovery of flaking floors/artefact manufacture areas.
- Recovery of dating samples.
- Encountering of site or stratigraphic features that in the opinion of the archaeologist are likely to be especially informative for the assessment of value and significance.
- Expansion would be limited to a maximum of an additional 40 m² over the AHIP area, and/or would cease once enough information has been recovered to adequately characterise the objects present with regard to their nature and significance, whichever occurs first.

4.4.4 Rehabilitation of Excavation Locations

Test Pits will be back-filled as soon as practicable after excavation. Backfilling will utilise original soil where possible. Where imported fill is required to be backfill, clean fill (crushed rock, sand) or other fill, it will be sourced from a location which has been identified as not having the potential for Aboriginal objects to be present.

4.4.5 Sample Collection

All material recovered from the test pits will be dry sieved using, at a minimum, a 3mm mesh size.

It may be necessary to step out or shore test pits when excavating at depth in sandy profiles. Where this occurs, the sieving of soil excavated for safe work methods rather than as part of the sample being investigated will be at the discretion of the Excavation Director.

All cultural material or environmental samples recovered will be carefully bagged and labelled with a unique identifier.

Charcoal or shell dating samples will be collected and a representative sample will be processed where appropriate samples are identified. OSL dating samples will also be collected if required. This analysis will only be undertaken when it will add significantly to an understanding of the site's stratigraphy.

4.5 Artefact cataloguing

A full record and catalogue of the artefacts will be prepared in accordance with Requirement 19 and 20 of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW 2010*.

Artefact analysis and the preparation of a catalogue will be conducted by Niche.

4.6 Short and long term storage of artefacts

The long term disposition of artefacts will require placing artefacts back on site at completion of works, unless the RAPs agree to a Care and Control Agreement. Any artefacts recovered during excavation will be temporarily held by Niche in a locked cupboard at the Niche Environment and Heritage Office located at Level 1, Suite 1.01B, 460 Church Street, Parramatta 1750.

4.7 Stone artefact attribute recording and analysis

A comparison of any artefact assemblages will be carried out. Variables noted would include provenance information, raw material type, presence of cortex, artefact type, maximum size, oriented size measures for complete and modified artefacts, weight, flake shape, flake platform, core type and core flaking pattern.

An archaeologist with skills in stone artefact identification will analyse, record and catalogue the artefacts in a laboratory post-excavation.

4.8 Shell attribute recording and analysis

All shell material recovered during the archaeological test excavation would be assessed to determine whether it was deposited naturally (through environmental processes), or as the result of Aboriginal (shell midden) use, and subsequently recorded. If Aboriginal shell midden is recovered during the excavation, further analysis of these materials would be undertaken. The shell analysis would aim to provide information on the following:

- What shellfish were consumed and in what quantities?
- What do variations in pH levels and shell concentrations indicate about site disturbance?
- When was the shell discarded?

In terms of analysis, all shell fragments recovered during sieving would be sorted by species for each excavated unit and subjected to the quantitative measurements described below, including total weight, total weight of fragments, minimum number of individuals (MNI), presence/absence of burnt shell, and presence/absence of modified shell. For the purpose of this study, MNI values would be obtained by counting the number of bivalve hinges, and the overall value halved.

All midden material recovered from the excavation will be analysed to provide information about the use, size and components of the midden. A sample of shell will be dated, where possible.

4.9 Faunal remains attribute recording and analysis

If faunal material is encountered, we would undertake analysis to determine:

- What animals/fish were consumed and in what quantities?

All animal/fish fragments recovered during sieving would be sorted by species for each excavated unit and subjected to the quantitative measurements described below, including: total weight, total weight of fragments, minimum number of individuals (MNI), presence/absence of burnt bone, presence/absence of modified bone.

4.10 Skeletal remains

The research AHIP will not apply to human remains. If any human remains are discovered and/or harmed in, on or under the land, personnel must:

- Not further harm these remains.
- Immediately cease all work within this location.
- Secure the area so as to avoid further harm to the remains.
- Notify the local police and OEH's Enviroline on 131 555 as soon as practicable and provide any available details of the remains and their location.
- Not recommence any work at the particular location unless authorised in writing by OEH.

4.11 Personnel

One excavation team is proposed, consisting of two suitably qualified archaeologists and four to six site officers from the RAPs. Roles within the teams would be flexible, and it is expected that members would rotate through roles including excavation, recording and sieving. Generally, two team members would excavate, two team members would sieve, and two would record. The team is expected to excavate 4 pits per day in good conditions.



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Drawn by: MH Project Manager: MD Date: 2/28/2019 Project Number: 4017 T:\spatial\projects\4000\4017_NelsonBayRd_Annabay_HA Maps\report\AHIP\4017_Figure_5_TestExcavations_AHIP.mxd



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Locations of test excavation pits

4017 Anna Bay Sand Quarry

FIGURE 5

Imagery: (c) Nearnmap 2018-09-09

4.12 Methods of assessing heritage significance

Heritage significance will be assessed by considering each cultural or archaeological site against the significance criteria set out in the *DECCW Aboriginal Cultural Heritage Standards and Guidelines Kit* and the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011: 18)

4.13 Contingency for unforeseen circumstances

Should the excavation uncover asbestos or any other suspicious contaminants, or unexpected services or utilities the following protocol will be followed:

- all work will cease in the area;
- the excavation team will then move to another trench to continue work;
- clarification and clearance will be sought from a suitably qualified specialist;
- the pit being excavated would be moved 10 to 20 meters on either side of the existing location when possible to continue the investigation; and
- if the area cannot be made safe it will be abandoned.

4.14 Sensitive Cultural Information- Management Protocol

During the consultation process Tattersall Lander Pty Ltd and Niche will provide the opportunity for RAPs to provide cultural information, including a statement of the value of identified sites and other matters. The input points for this have been listed in the ACHA; however, information will be **accepted at any point during the Project or prior to the finalisation of the ACHA report**.

Please be aware that Tattersall Lander Pty Ltd and Niche staff may seek cultural information and supporting evidence in regard to matters of cultural value.

In the event that a RAP has sensitive or restricted public access information, it is proposed that Tattersall Lander Pty Ltd will manage this information, on behalf of Hay Enterprises NSW Pty Ltd, (if provided by the Aboriginal community) in accordance with a sensitive cultural information management protocol. It is anticipated that the protocol will include making note of and managing the material in accordance with the following key limitations as advised by Aboriginal people at the time of the information being provided:

- Any restrictions on access and material
- Any restrictions on communication of the material (confidentiality)
- Any restrictions on the location/storage of the material
- Any cultural recommendations on handling the material
- Any names and contact details of persons authorised within the relevant Aboriginal group to make decisions concerning the Aboriginal material and degree of authorisation.
- Any details of any consent given in accordance with customary law
- Any access and use requirements/ requests by the RAPs of the cultural information in the material.

4.15 Critical Timelines

Critical timelines for the ACHA are outlined in Table 5. Please note that some of these timeframes are estimates at this stage in the process and are provided to allow forward planning of personnel and resources.

Table 5: Critical timelines for the Anna Bay Sand Quarry ACHA

Project item	Due date
Provision of the draft ACHA report and AHIP test excavation methodology (including the proposed management and mitigation measures) to registered Aboriginal stakeholders for review.	08 March 2019, cut-off date 28 days later 08 April 2019
AHIP submission	16 th April 2019, OEH has 60 days to assess 11 th June 2019
7 days prior to excavation OEH notified of AHIP initiation	July 2019, cut-off date June/July 2019
AHIP testing program	July 2019
Development of ACHA/AR for potential harm/Destroy AHIP	Within two weeks of completion of testing program.

4.16 Who to contact

If you would like to provide information for the methodology or ACHA, or if you would like to discuss the project do not hesitate to contact:

Dr Morgan Disspain
 Senior Heritage Consultant
 Niche Environment and Heritage
 PO Box 2443
 North Parramatta NSW 1750
 T: 0488 774 566
 E: mdisspain@niche-eh.com

5. References

- Anna Bay Public School, 2014. A Brief History of Anna Bay and its School. URL <http://www.annabay-p.schools.nsw.edu.au/documents/31694767/31702034/A%20BRIEF%20HISTORY%20OF%20ANNA%20BAY%20AND.pdf>
- Dean-Jones, P., 1990. Newcastle Bight Aboriginal Sites Study. A Report to the NSW National Parks and Wildlife Service and National Estate Grants Committee.
- Eric Martin and Associates, 2002. Tomaree Head Conservation Management Plan. Prepared for NSW National Parks and Wildlife Service.
- McCardle Cultural Heritage Pty Limited, 2015. MR 108 Nelson Bay Rd. Bobs Farm to Anna Bay Stage 3 – Cromarty Lane to Port Stephens Drive. Archaeological Salvage AHIP 1132063. Volume 1. A report to Roads and Maritime Services.
- McCardle Cultural Heritage Pty Limited, 2016. 781 Marsh Road, Bobs Farm Archaeological Due Diligence Assessment. Unpublished report prepared for Sorensen Design and Planning.
- Niche Environment and Heritage, 2018a. Anna Bay Sand Quarry 4226 Nelson Bay Rd, Anna Bay – Historical Heritage Impact Statement. Unpublished report prepared for Hay Enterprises (NSW) Pty Ltd.
- Niche Environment and Heritage, 2018b. Anna Bay Sand Quarry: Aboriginal Objects Due Diligence Assessment. Unpublished report prepared for Tattersall Lander Pty Ltd.
- Niche Environment and Heritage, 2019. Anna Bay Sand Quarry: Aboriginal Cultural Heritage Assessment. Unpublished report prepared for Tattersall Lander Pty Ltd.

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

Appendix C: Aboriginal Community Consultation

Appendix C: Consultation records

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B1 Stage 1 – Notification of project proposal and registration of interest

B1.1 Notification of agencies

Request for Search of Tribunal Registers

*mandatory fields are marked with an asterisk

1. Your details*

NAME:	Caitlin Marsh
POSITION:	Heritage Consultant
COMPANY/ORGANISATION:	Niche Environment and Heritage
POSTAL ADDRESS:	PO BOX 2443 North Parramatta NSW 1750
TELEPHONE:	0488 224 014
EMAIL:	cmarsh@niche-eh.com
YOUR REFERENCE:	4017ACHA
DATE OF REQUEST:	17/4/2018

2. Reason for your request - please complete either Part A OR Part B*

Part A - Are you a party to a native title proceeding? ☐ Yes ☐ No

Please provide Federal Court/Tribunal file number/or application name:

OR

Part B - Do you need to identify existing native title interests to comply with the *Native Title Act 1993* (Cth) or other State/Territory legislation? ☒ Yes ☐ No

Please provide brief details of these obligations here:

3. Identify the area to be searched - please complete either Part A OR Part B*

Part A - Mining tenure

Tenement ref/s:

State/Territory:

OR

Part B - Other tenure type

- ☒ Crown Land, crown reserve
- ☒ Agricultural/pastoral lease
- ☒ Freehold (privately owned)**

State/Territory:

Local Government Area:

4. Description (please provide as many details as possible)

Provide any additional details to describe the area, including attaching maps with landmarks clearly shown.

Lot and plan details:

Property name:

Pastoral Lease number or name:

County:

Parish:

Town:

Section:

Hundred:

Northern Territory Portion:

5. Submit your request

NNTT Office	Search jurisdiction	Email address	Fax
Perth	WA searches	waenquiries@nntt.gov.au	(08) 9425 1193
Melbourne	VIC, TAS searches	vicandtasenquiries@nntt.gov.au	(03) 9606 0680
	SA, NT searches	sa_and_ntenquiries@nntt.gov.au	(03) 9606 0680
Sydney	NSW, ACT searches	nswenquiries@nntt.gov.au	(02) 9227 4030
Brisbane	QLD searches	qldenquiries@nntt.gov.au	(07) 3307 5050

Or post to: National Native Title Tribunal, GPO Box 9973 (Perth 6848, Melbourne 3001, Sydney 2001, Brisbane 4001)

- There is no charge for conducting searches of the Tribunal's databases.
- Timeframe for providing results is generally 3-5 business days.
- Register and schedule extracts, plus map attachments will be provided with your results. Technical coordinates may be omitted.

Did you know?

Native Title Vision (NTV) is the National Native Title Tribunal's free online visualisation, mapping and query tool. All that is needed to use NTV is a computer connected to the internet, a current web browser and an NTV user account. NTV puts you in the driver's seat in exploring native title and brings together:

- a geospatial view of the Tribunal's registers and databases
- overlays of administrative regions, non-freehold land parcels and resources tenure.

To obtain a NTV user account visit the [Geospatial section](#) on our website.

****Native title & freehold tenure**

Under the *Native Title Act 1993* (Cth), the valid grant of a freehold estate (other than certain types of Aboriginal and Torres Strait Islander land) on or before 23 December 1996 is known as a 'previous exclusive possession act'. This means that native title has been extinguished over the area.

The Tribunal is not the custodian of the data for freehold estates. To determine whether a particular parcel of land is freehold land, you may wish to seek such information from the relevant state/territory government custodian.

24 April 2018

Office of Environment and Heritage - Hunter Central Coast Regional Operations Division
Mr Steven Cox
Locked Bag 1002
Dangar NSW 2309
rog.hcc@environment.nsw.gov.au

Dear Steven Cox,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

In accordance with Section 4.1.3 of the Office of Environment and Heritage *Aboriginal Cultural Heritage Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) and Clause 80C of the NSW National Parks and Wildlife Regulation 2009, Tattersall Lander will conduct a community consultation process with relevant Aboriginal people to assist Tattersall Lander with the preparation of an Aboriginal Cultural Heritage Assessment to inform the Environmental Impact Statement (EIS) and comply with the Department of Planning's Secretary's Environmental Assessment Requirements (SEARS 1172). The requirements of the SEARS 1172 are as follows:

"An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage".

Where an Aboriginal Heritage Impact Permit is required, the purpose of the community consultation with Aboriginal people will be to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of the application.

In accordance with Section 4.1.2 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010), we are seeking the names and contact details of Aboriginal groups or individuals that may have an interest in the project and hold knowledge relevant to determining the cultural significance of the Subject Areas.

We would appreciate correspondence regarding this matter by 5pm on 10 May 2018. Contact details of Aboriginal groups and/or individuals can be forwarded to:

Tattersall Lander
c/ Jess Cuskelly
Niche Environment and Heritage

PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 224 968
Email: jcuskelly@niche-eh.com

Tattersall Lander will write to each Aboriginal person or group whose details are provided to notify them of the proposed project and invite them to register an interest in the community consultation process. The Proponent's contacts details are: Tattersall Lander Pty Ltd, PO Box 580 Raymond Terrace NSW 2324, PH: 4987 1500

Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage

Figure 1: General location of the Subject Area, with the boundary outlined in red.

24 April 2018

Hunter LLS
Mr Toby Whaleboat
toby.whaleboat@lls.gov.au

Dear Toby Whaleboat,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

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PO Box 2443
North Parramatta NSW 1750

Telephone: 0488 224 968

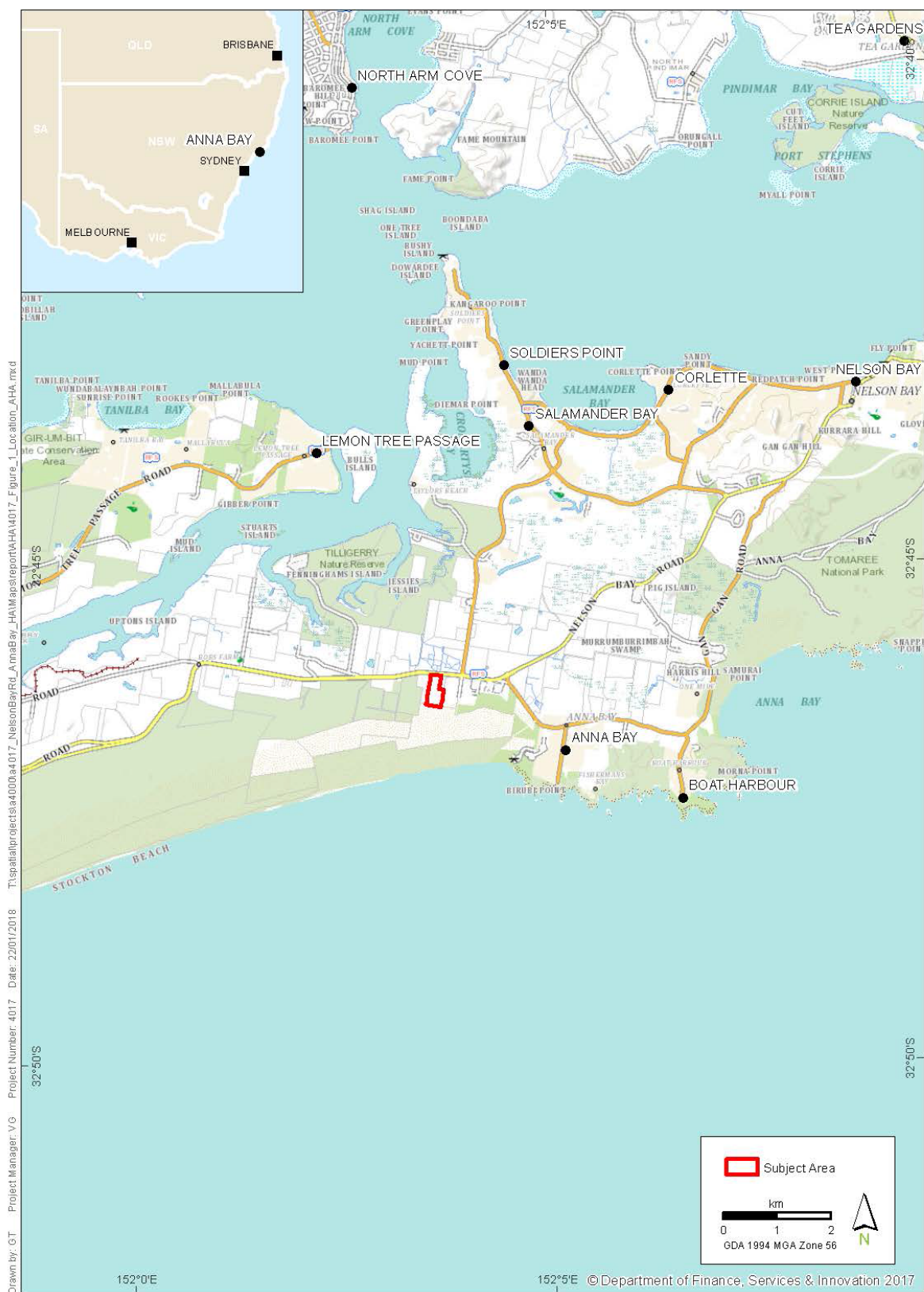
Email: jcuskelly@niche-eh.com

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Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage



Location map

Anna Bay Sand Quarry Aboriginal Heritage Assessment

FIGURE 1

Figure 1: General location of the Subject Area, with the boundary outlined in red.

24 April 2018

Office of the Registrar Aboriginal Land Rights Act 1983 (NSW)

PO Box 5068
Parramatta NSW 2124
adminofficer@oralra.nsw.gov.au

Dear Sir or Madam,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

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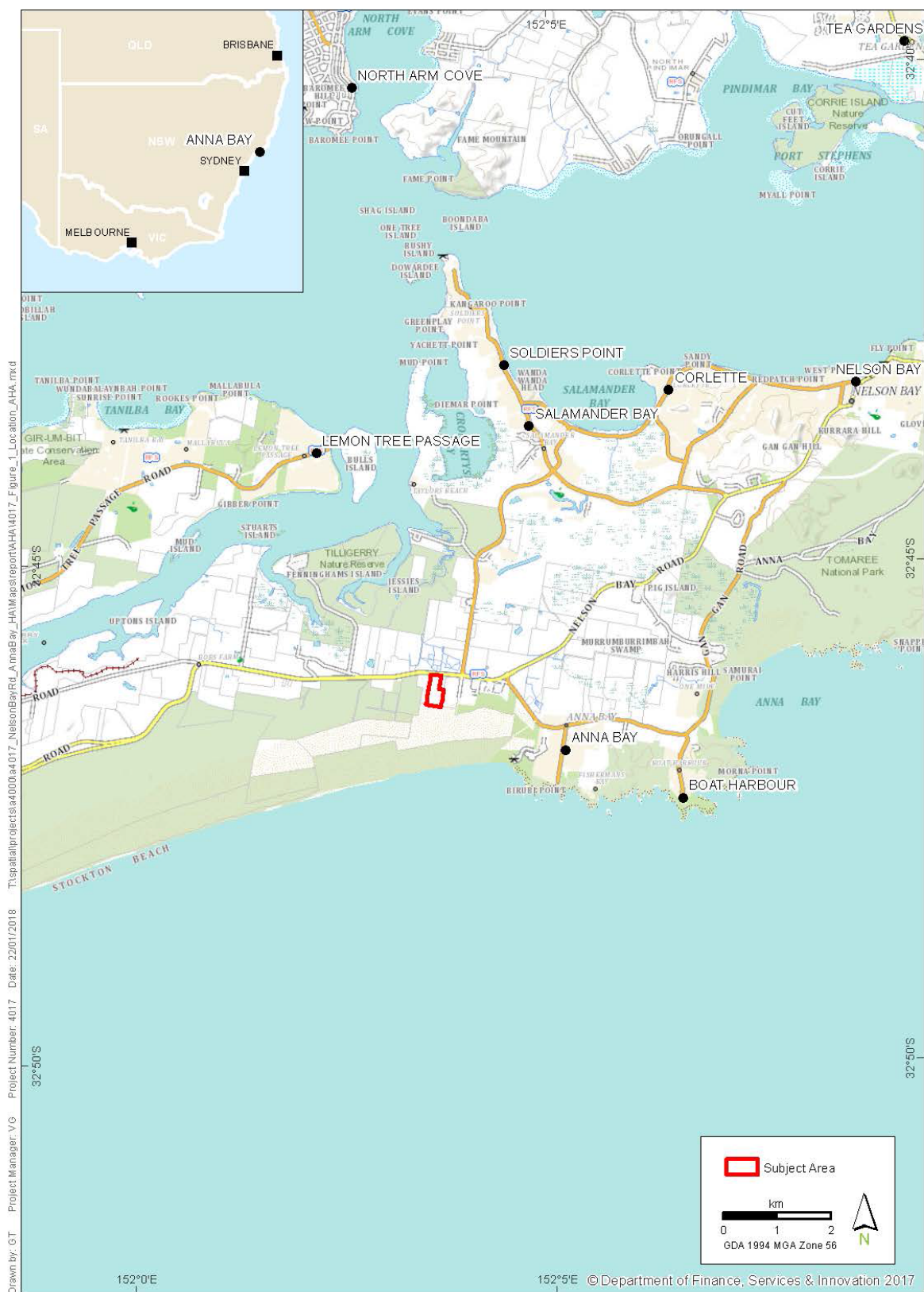
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Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map

Anna Bay Sand Quarry Aboriginal Heritage Assessment

FIGURE 1

Figure 1: General location of the Subject Area, with the boundary outlined in red.

24 April 2018

Port Stephens Local Council

116 Adelaide St
Raymond Terrace NSW 2324
Dear Sir or Madam,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

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PO Box 2443
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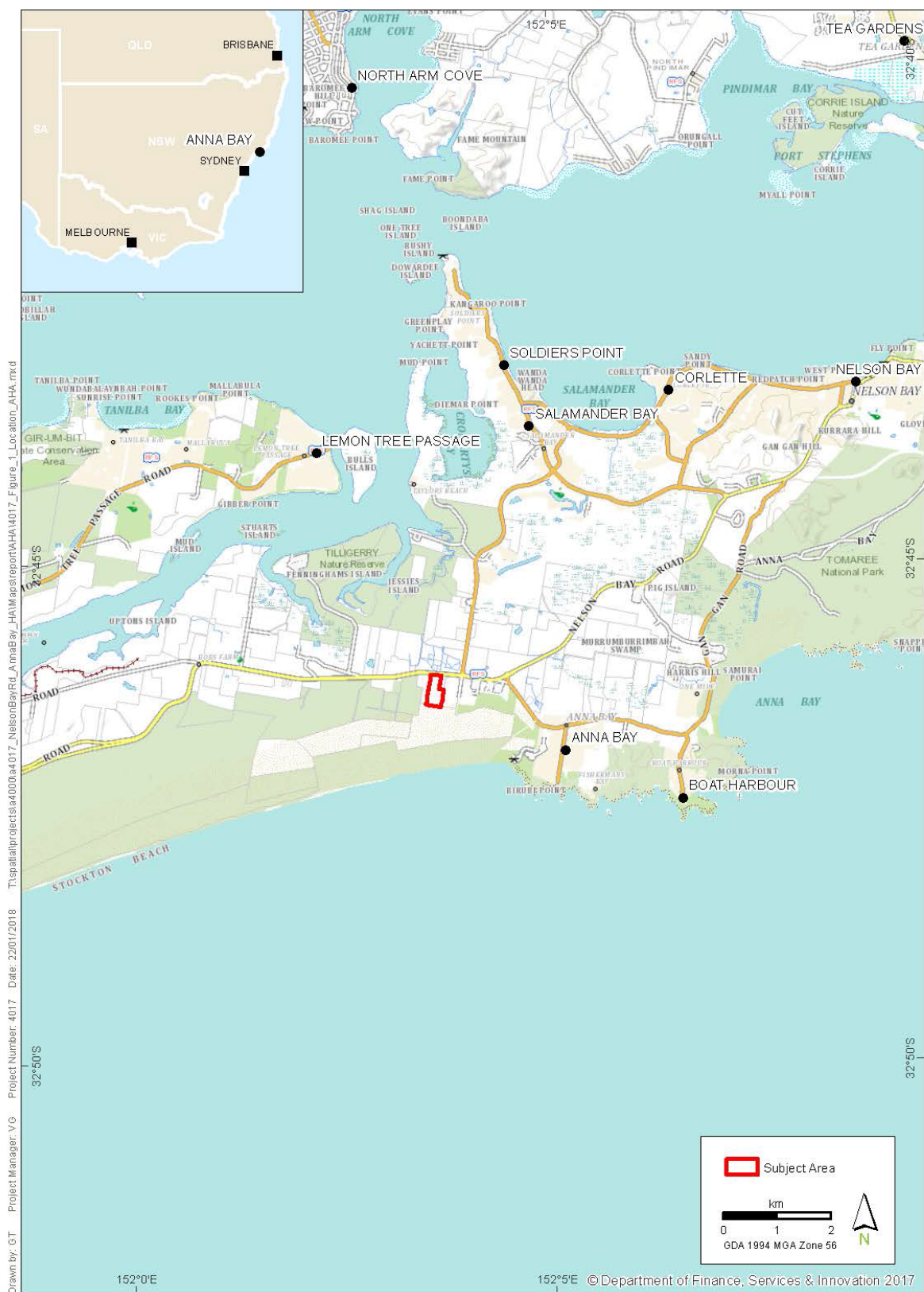
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Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map

Figure 1: General location of the Subject Area, with the boundary outlined in red.

24 April 2018

Worimi Local Aboriginal Council

2163 Nelson Bay Rd
Williamtown NSW 2314
Dear Sir or Madam,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

In accordance with Section 4.1.3 of the Office of Environment and Heritage *Aboriginal Cultural Heritage Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) and Clause 80C of the NSW National Parks and Wildlife Regulation 2009, Tattersall Lander will conduct a community consultation process with relevant Aboriginal people to assist Tattersall Lander with the preparation of an Aboriginal Cultural Heritage Assessment to inform the Environmental Impact Statement (EIS) and comply with the Department of Planning's Secretary's Environmental Assessment Requirements (SEARS 1172). The requirements of the SEARS 1172 are as follows:

"An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage".

Where an Aboriginal Heritage Impact Permit is required, the purpose of the community consultation with Aboriginal people will be to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of the application.

In accordance with Section 4.1.2 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010), we are seeking the names and contact details of Aboriginal groups or individuals that may have an interest in the project and hold knowledge relevant to determining the cultural significance of the Subject Areas.

We would appreciate correspondence regarding this matter by 5pm on 10 May 2018. Contact details of Aboriginal groups and/or individuals can be forwarded to:

Tattersall Lander
c/ Jess Cuskelly
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750

Telephone: 0488 224 968

Email: jcuskelly@niche-eh.com

Tattersall Lander will write to each Aboriginal person or group whose details are provided to notify them of the proposed project and invite them to register an interest in the community consultation process. The Proponent's contacts details are: Tattersall Lander Pty Ltd, PO Box 580 Raymond Terrace NSW 2324, PH: 4987 1500

Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage

24 April 2018

NTS Corp Limited
Mr Peter Shultz
PO Box 2105
Strawberry Hills NSW 2012
Dear Peter Shultz,

Re: 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period.

In accordance with Section 4.1.3 of the Office of Environment and Heritage *Aboriginal Cultural Heritage Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) and Clause 80C of the NSW National Parks and Wildlife Regulation 2009, Tattersall Lander will conduct a community consultation process with relevant Aboriginal people to assist Tattersall Lander with the preparation of an Aboriginal Cultural Heritage Assessment to inform the Environmental Impact Statement (EIS) and comply with the Department of Planning's Secretary's Environmental Assessment Requirements (SEARS 1172). The requirements of the SEARS 1172 are as follows:

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Where an Aboriginal Heritage Impact Permit is required, the purpose of the community consultation with Aboriginal people will be to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of the application.

In accordance with Section 4.1.2 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010), we are seeking the names and contact details of Aboriginal groups or individuals that may have an interest in the project and hold knowledge relevant to determining the cultural significance of the Subject Areas.

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c/ Jess Cuskelly
Niche Environment and Heritage
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Telephone: 0488 224 968

Email: jcuskelly@niche-eh.com

Tattersall Lander will write to each Aboriginal person or group whose details are provided to notify them of the proposed project and invite them to register an interest in the community consultation process. The Proponent's contacts details are: Tattersall Lander Pty Ltd, PO Box 580 Raymond Terrace NSW 2324, PH: 4987 1500

Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage

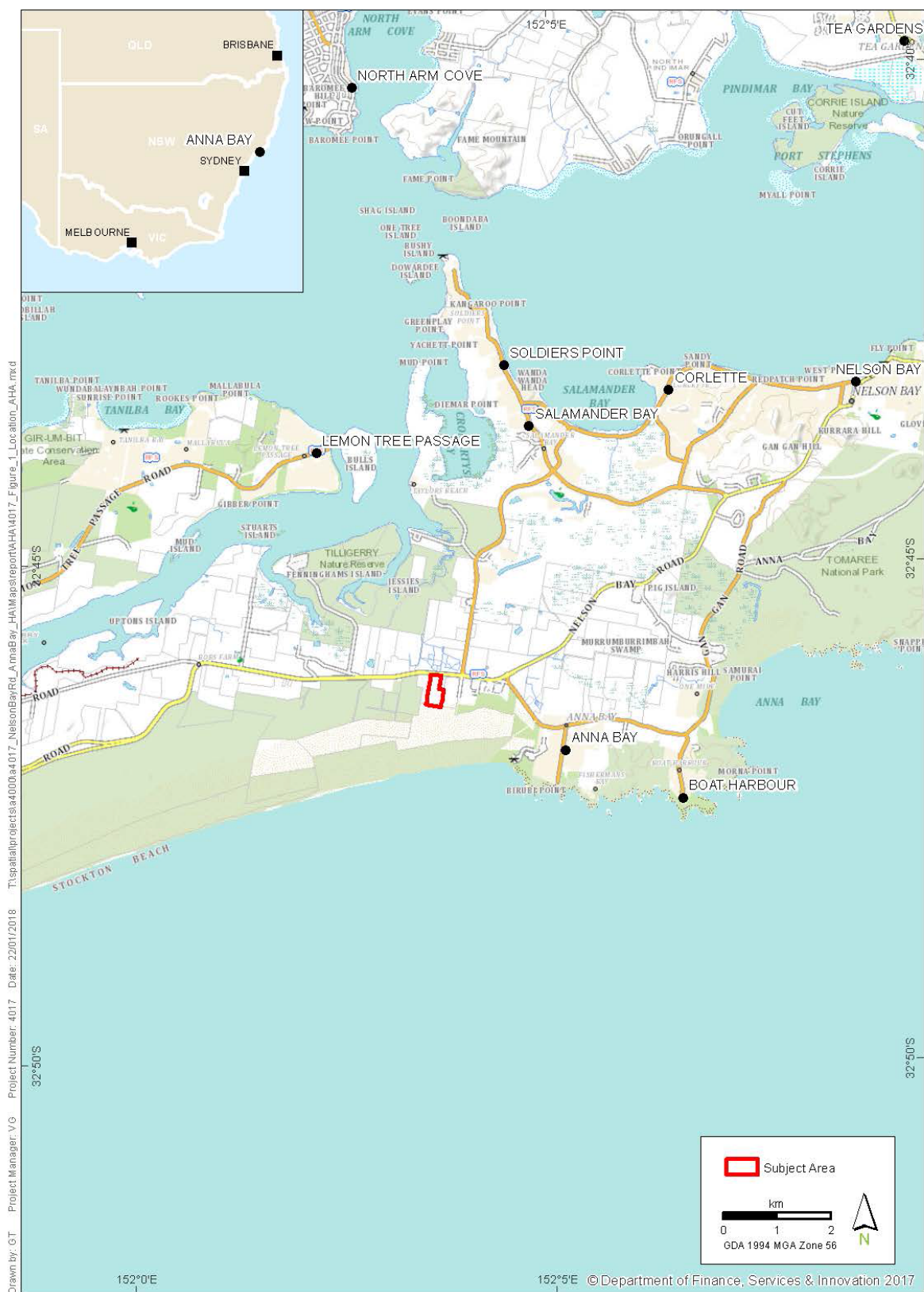


Figure 1: General location of the Subject Area, with the boundary outlined in red.

B1.2 Advertisement

Place your ad in the News Of The Area classifieds - THEY WORK!

Very Low Rates!

Special "RUN TIL SELL" options too!

SOLD

SOLD

SELL Locally with NOTA

SOLD

Public Notices

AGM
Myall Masters Swimming Club
 to be held in the Committee Room
 Tea Gardens Pool
1st May at 7pm
 All members welcome.

GUITAR & BASS
 Tuition Theory & Musicianship.
 Studio Fantabulous
 N/Bay. 25yrs exp
 49844731

Public Notices

Myall Park Tennis Club
PLAYERS WANTED
 for New Thursday Night Comp.
 Expressions of Interest sort for new Club Competition.
 Grading 26th April.
 To register your interest phone
 Robyn 0408412680
 Visit our website for more info.
www.tennis.com.au/hawksnest

Garage Sale

HUGE Combined
 Garage Sale Saturday
 28 April 8 am to 2pm. At 1 Starboard Way, Tea Gardens. Books, DVDs, CDs, Curtains, Ornaments, hand bags, shoes, jewellery, crockery, clothes, toys and paintings, lots more.

CLASSIFIEDS in the News Of The Area
ads@mcnota.com.au
 Email for Price & Proof

For Sale

1940's upholstered 2seater lounge and 2 chairs call 49970694 to inspect \$200 ono

ANTIQUE cedar d/ side table \$150. 0423 309410

ANTIQUE bottles, furniture & collectibles plus 2 beach rods and ALVEY Reel. Phone: 02 4984 1198

BARIATRIC Wheelie Walker. As new, \$200. Raymond Tce Ph 0414531597

BBQ matador Functional 6 burner with Side pot cooker, gas Bottle, tools and manuals. Almost new. \$850 ono. 49198044

BOBBIN sanding machine. Carba-tec complete with four bobbin sizes, extra sleeves and cabinet. As new \$280. 49844510 / 0439437047

CLASSIFIEDS in the News Of The Area
ads@mcnota.com.au
 Email for Price & Proof

CHAISE 3 seater lounge. Light grey 7 months Old \$600 0408401999

For Sale

DINNER set willow pattern six places 49191637 \$30 Soldiers Point

CLASSIFIEDS
ads@mcnota.com.au

ELECTRIC chair near new \$450. 499704 Tea Gardens

FLATTOP truck conversion to utility sides back and front \$850 4997 0986

FREEZER Westinghouse 6 drawers 180Ltr. \$299 or \$499 very good condition. Ph 49979783 Tea Gardens

FRONT door fly screen, heavy duty fancy shell motive, with key. \$275 4997 0986

GENKI Advanced Fitness Inversion Table for Gravity Back Pain and Exercise Home Gym. Hardly used. \$80 ono. Kerrie Wright. 49970960 Tea Gardens

GRAMOPHONE wind up, good working cond, needles available. \$500. Phone 4997 0986

GUITAR and Amp Strat copy guitar Three pick ups and quiver arm. 40 watt amp with 4 inputs and 1 mic input. A1 condition. \$320 0419212863

GUITAR Squire Acoustic With bag, strap, 3 plects, Stand, learning book. \$150 Lectern - wooden 1m Good condition \$35 0451098759

HALL Cabinet. Text for pictures. Solid Timber & Glass 1.85h x 1.68l x .45d. \$600 0428450925

IKEA toddler bed \$50. Soldiers Point 49827995

HIGH Back Cane Dining Chairs (8) Good condition. \$50 each or 8 for \$350. Phone 0415 419 741

CLASSIFIEDS in the News Of The Area
ads@mcnota.com.au
 Email for Price & Proof

KAYAK MINI-X 3m. Model MALIBU-KAYAK. Near new, has seat, Paddle, set of PONTOP wheels and bike trailer with bike attachments \$575 the lot 0417821805

For Sale

KING, AH Beard Comfort Plush Mattress. \$800. 0428450925 Email for pictures.

CLASSIFIEDS in the News Of The Area
ads@mcnota.com.au
 Email for Price & Proof

KITE Surfer, Naish. Kite with harness & directional board. Used once. \$450 Ph 0402290498

LOBSTER brooch. Yellow gold, diamonds and rubies. Valued at \$2950. Sell for \$1800. 0405203113

LOUNGE Cream 2 seater lounge \$45 and single armchair \$15 0427861227

LOUNGE suite dark blue leather 3seater and 2 armchairs in good cond. \$500. Lg timber extendable 49820432 Salamander.

MACROB timber extension dining table and 6 leather chairs with 3 matching wall units and entertainment unit. \$500. 0407283748 Text for photos

MOBILITY scooter Travelscot folds down. Good cond. \$700 ono ph 49877006

MOBILITY scooter travel scoot. Folds down, stores in Car boot. 12v bag and Lamps wool seat cover. Good Cond. \$750 Ono 0417213700

MOTOROLA mobile phone. 4G enabled unlocked. 4 months warranty remaining. As new. Purchase price \$149. Will sell for \$100. 49842583

OAK Dining table \$190 Extension with 6 chairs. Like new 0405 388 607

OUTDOOR Dining Setting. Black Glass Top Table 90 cm x 150 cm with 6 Folding Chairs \$85 Excellent Cond. 0402246253

PEARL mobility scooter, gd cond, very little use, new 12v accessories, fit in medium size boot \$950 Ph 4997 0986

POOL table. Three-quarter size, slate top 220 long 120 wide, excel cond \$1500. 0404477158

CLASSIFIEDS
ads@mcnota.com.au

For Sale

PRIDE Go Go Elite Traveller motor scooter with hoist (suitable for 4WD vehicles). Recently serviced, both batteries replaced, new front basket and manual. \$750 negotiable. Will separate hoist and scooter. Ph 0428291907

QB ensemble. Very Good condition. \$300 ono. 0417229070

ROWING Skiff - Euro Single. Croker Blades VG cond, \$1500 ono 0418716225

SOFA bed, plush, black, one year old, bed used only once, \$300 Ph 0427 204 450

STEELCRAFT pram \$100. Fr Newborn up Includes accessories & weather cover 0419618565

SURF Ski - Wave Master. Good condition very stable. Good in surf as well as calm/choppy conditions. Includes paddle \$375. 49822004

SWINGING metal entrance gates with latches \$300 4997 0986

TIMBER dining suite \$250 very good cond. Tea G/dns 49198091

TIMBER lounge solid 3 piece - 3 seater and 2 armchairs. \$500 0428970662

TIMBER queen bed head and Frame exc condition \$75 Ono 49971529

TREADMILL Electric walker pro form 400c. Brand new condition \$500 call John 49970435

CLASSIFIEDS
ads@mcnota.com.au

TWO QB air mattresses and elec. pump \$60 Ono for both 49841127 Nelson Bay

TYRE on steel rim, Yokohama Geolander as new 215/70R/16 \$75. ph 0416229166

UMBRELLA Shelta cantilever with canvas canopy. As new. \$500 ono 49972359

WELDER Generator 14HP petrol motor electric start 200amp welder & leads 3.5kva 240V very good welder. \$1500.00 email don@legges.id.au Ph. 0418845358

Items

DRIVE socket set, 3/4 drive in ex cond. Sizes up to 2 inch & 150mm \$60.00. Rotary Ozito Hammer drill 710W. VG \$50.00. 230mm Ozito Angle grinder only used once. \$60.00. Full Oxy/Acetylene Welding set. Less hoses. \$100. Genuine reason for selling. Ph. 4982 4249

ELECTRIC lift chair. Strong chair, beige Fabric \$350 Pride shopping scooter, 3 piece for light Easy car transport \$260 requires new battery Priced accordingly. 49970930 Tea Gardens

CLASSIFIEDS in the News Of The Area
ads@mcnota.com.au
 Email for Price & Proof

OAK High quality dining table with six refurbished chairs and matching oak sideboard \$800 ono. Light brown elegant Lounge suite - 2 armchairs and one 3 seater. Matching Lamp and Oak Coffee table Sell as a set - make an offer \$200. Grey metal filing cabinets, 4 drawer \$60, 2x 3 drawers \$40 each, 3x bookshelves timber \$50-\$100, 4x Garage shelves metal \$200 for all. 49972294 Hawks Nest

OZITO Bandsaw \$100. OZITO Bench Saw \$100. RYOBI Bench Grinder \$60. RHINO Pedestal Drill \$80. OZITO Cordless Drill & Battery \$30. 2hp Tank Compressor \$100. Stud Finder \$20. Planer \$80. Orbital Sander \$40. Portable Petrol Container \$20. Power Master Angle Grinder \$60. Timber Work Bench \$60. Phone: 02 4981 0681

PARROT cage large, \$50. Chest of drawers macadamia wood \$50. Queen side bed ensemble Good cond. \$60. Recliner chair \$30. 49844123 Nelson Bay

RYOBI electric blower, Bosch electric drill w/ 2 chargeable batteries Also lots of tools & Electrical equipment. 49820432

CLASSIFIEDS
ads@mcnota.com.au

ROUND timber antique. Table 740cm \$200. Repco exercise bike \$40. Four Toyota 6 stud split rims \$120 for all. 0429485169 Nelson Bay

More ITEMS Over The Page

Public Notices



MIDCOAST
 council

www.midcoast.nsw.gov.au

IMPORTANT PUBLIC NOTICE Fox Baiting Program

MidCoast Council, with support from the Hunter Local Land Services, and in cooperation with adjoining neighbours will be undertaking 1080 fox baiting within the Bulahdelah Plain Council Reserve, Lot 601 DP1171576 Booral Road Bulahdelah and 334 ha of private conservation lands at 158 Burdekins Road and 244 Myall River Road Bulahdelah.

The program will use 1080 meat baits and FOXOFF® poison baits designed specifically for fox control. Baits will be buried to reduce the risk of non-target poisoning.

The program will be conducted from Wednesday 2 May and be completed by Wednesday 30 May 2018.

The use of 1080 poison baiting is to be conducted to control the impacts of fox predation on native wildlife including threatened species. All areas will have 1080 baiting signs erected on the main access tracks where the baiting is undertaken.

Warning: 1080 poison is lethal to domestic animals. For more information phone Peter Goonan at MidCoast Council on 6591 7306.

PO BOX 450
 FORSTER NSW 2428

© NOTA Graphics - Ref MCCO_200418

(02) 6591 7222
council@midcoast.nsw.gov.au

Public Notices

4226 NELSON BAY ROAD. ANNA BAY NSW ABORIGINAL CULTURAL HERITAGE ASSESSMENT

Tattersall Lander (the Proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) prior to the Department of Planning & Environment providing consent for the construction of a sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (The Subject Area), which backs onto the Newcastle Bight sand dune system. The proposed quarry proposes to extract a maximum of 50,000 cubic metres of sand in one year over a 30 year period.

In accordance with Section 4.1.3 of the Office of Environment and Heritage Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010, Tattersall Lander is seeking to consult with any Aboriginal persons or groups who may hold cultural knowledge of, or who have the right or interest in Aboriginal cultural heritage of the project area. The purpose of the consultation will be to assist Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment to inform the EIS and comply with the Department of Planning's Secretary's Environmental Assessment Requirements (SEARS 1172). The requirements of the SEARS 1172 are as follows:

"An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage".

The Proponent is inviting Aboriginal people or groups who hold cultural knowledge relevant to determining the significance of the Subject Area to register their interest for the consultation process. All registrations for the project must be received by 5pm on 9th May 2018 and should be directed in writing to:

Tattersall Lander Pty Ltd
 c/- Jess Cuskelly
 Niche Environment and Heritage
 PO Box 2443
 NORTH PARRAMATTA NSW 1750
 Telephone: 0488 224 968
 Email: jcuskelly@niche-eh.com

Proponent's contacts details are: Tattersall Lander Pty Ltd, PO Box 580 Raymond Terrace NSW 2324, PH:4987 1500

B1.3 Notification of potential stakeholders

30 May 2018

To whom it may concern,

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Please be advised that your contact details have been provided by the NSW Office of Environment and Heritage (OEH) in accordance with Section 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents* as a potential Aboriginal stakeholder who may have interest in registering to the abovementioned project.

Niche Environment and Heritage has been commissioned by Tattersall Lander (the Proponent) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (hereafter referred to as the Subject Area) (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period. The EIS will support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)*.

In accordance with Section 4.1.3 of the Office of Environment and Heritage *Aboriginal Cultural Heritage Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water, 2010) and Clause 80C of the NSW National Parks and Wildlife Regulation 2009, Tattersall Lander will conduct a community consultation process with relevant Aboriginal people to assist Tattersall Lander with the preparation of an Aboriginal Cultural Heritage Assessment to inform the Environmental Impact Statement (EIS) and comply with the Department of Planning's Secretary's Environmental Assessment Requirements (SEARS 1172). The requirements of the SEARS 1172 are as follows:

"An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage".

Aboriginal people who hold cultural knowledge relevant to determining the significance of Aboriginal object(s) and/or place(s) in the area of the proposed project are invited to register an interest in a process of community consultation with Tattersall Lander.

Where an Aboriginal Heritage Impact Permit is required, the purpose of the community consultation with Aboriginal people will be to assist the proponent in the preparation of an application for an Aboriginal Heritage Impact Permit and to assist the Director General of the Office of Environment and Heritage in his or her consideration and determination of the application.

The Proponent can be directly contacted on:

Tattersall Lander Pty Ltd
PO Box 580
Raymond Terrace NSW 2324

Written registration should be forwarded to:

Tattersall Lander
c/ Jess Cuskelly
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 224 968
Email: jcuskelly@niche-eh.com

Inclusion in the consultation process does not automatically result in paid site assessment. In accordance to Section 3.4 of the consultation guidelines, the decision on who is engaged for delivering particular services is decided by the proponent and will be based on a range of considerations including skills, relevant experience, and providing necessary certificates of currency.

Please be advised that, as per the *Aboriginal cultural heritage consultation requirements for proponents* (NSW Department of Environment, Climate Change and Water, 2010) the Proponent is required to forward the names of Aboriginal persons and groups who register an interest to the Office of Environment and Heritage and Worrimil Local Aboriginal Land Council, unless the person or group specifies they do not want their details released.

Please provide written confirmation of your registration by 5pm on 14th June 2018 to the address or email address above

Yours sincerely,



Balazs Hansel
Senior Archaeologist & Heritage Consultant
Niche Environment and Heritage

Drawn by: GT Project Manager: VG Project Number: 4017 Date: 22/01/2018 T:\spatial\projects\4000a\4017_NelsonBayRd_AnnabBay_HA\Map\report\AHAA4017_Figure_1_Location_AHA.mxd



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map

B1.4 Registrations

Samuel Ward

From: lilly carroll <didgengunawalclan@yahoo.com.au>
Sent: Wednesday, 30 May 2018 1:16 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW.
ACHA and possible AHIP application - Stage 1 Letter

Good afternoon Balazs

Didge Ngunawal Clan would like to register an interest into Re: sand quarry at 4226 Nelson bay Road Anna Bay

Kind regards DNC
Lilly carroll & Paul Boyd
0426823944

Sent from myMail for iOS

Wednesday, 30 May 2018, 1:10 pm +1000 from Balazs Hansel <bhansel@niche-eh.com>:

To whom it may concern,

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Please be advised that your contact details have been provided by the NSW Office of Environment and Heritage (OEH) in accordance with Section 4.1.2 of the Aboriginal cultural heritage consultation requirements for proponents as a potential Aboriginal stakeholder who may have interest in registering to the abovementioned project.

Niche Environment and Heritage has been commissioned by Tattersall Lander (the Proponent) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (hereafter referred to as the Subject Area) (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period. The EIS will support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)*.

In accordance with Section 4.1.3 of the Office of Environment and Heritage *Aboriginal Cultural Heritage Requirements for Proponents 2010* (NSW Department of Environment, Climate Change and Water,

Samuel Ward

From: Deidre Perkins <dedemaree3@hotmail.com>
Sent: Wednesday, 30 May 2018 2:13 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW.
ACHA and possible AHIP application - Stage 1 Letter

Hello Balazs,
I hope you are fine. I would like to register for The sand quarry at 4226 Nelson rd Anna Bay.
I have worked in cultural and heritage for over 15 years and have a great knowledge of the land, people and culture.
I am a fit wonneruah woman and would enjoy working with you on this project.
Thank you Deidre.

Get [Outlook for Android](#)

From: Balazs Hansel <bhansel@niche-eh.com>
Sent: Wednesday, May 30, 2018 1:10:55 PM
To: Clare Leever
Cc: Balazs Hansel; Jessica Cuskelly
Subject: 4017.- Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. ACHA and possible AHIP application - Stage 1 Letter

To whom it may concern,

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Please be advised that your contact details have been provided by the NSW Office of Environment and Heritage (OEH) in accordance with Section 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents* as a potential Aboriginal stakeholder who may have interest in registering to the abovementioned project.

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"An assessment of the potential impacts on Aboriginal heritage (cultural and archaeological), including evidence of appropriate consultation with relevant Aboriginal communities/parties and documentation of the views of these stakeholders regarding the likely impact of the development on their cultural heritage".



9 Vardon Road Fern Bay 2295 NSW
49281910
0402827482

ABN: 97 807 719 484

Thursday 14th June, 2018

Niche Environment and Heritage

Att: Tattersall Lander

c/o Jess Cuskelly

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW

To Jess,

Please find enclosed application for Murrooma Incorporated to register our interest to be a part of the community consultation process for this proposed project.

Murrooma have completed a due diligence of this proposed project area as outlined and advised Niche of our recommendations whilst onsite.

Anthony Anderson and Bec Young are representatives of Murrooma who both hold specific cultural knowledge and education relevant to determining the significance of Aboriginal objects and places in the Port Stephens/Anna Bay region. We are both Traditional Custodians of the Worimi area and are in a position to speak for country.

The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. We believe that in order to gain the specific information that will be required for this area, it must be sorted through Local Knowledge Holders and this is what we can offer in the consultation process.

Yours Truly

Bec Young- Operations Manager

Anthony Anderson- CEO

From: lennie.anderson011 lennie.anderson011
To: [Jessica Cuskelly](#)
Subject: Propoised Quarry Anna Bay
Date: Tuesday, 1 May 2018 6:05:02 PM

Hi Jess,

I would like to Register my interest in this Proposal, The other two Organisations I can recommend are Worimi LALC, and Murrooma Inc (there is a 4th Group Maingal) but they don't believe in insurances for onsite work.
Hoping this has helped!

Leonard James Anderson OAM (Lennie)

Nur-Run-Gee Pty Ltd (Director)

Worimi Traditional Custodian (Registered and Recognised)

This email has been scanned for spam and viruses by Proofpoint Essentials. Click [here](#) to report this email as spam.

From: [stephen talbott](#)
To: [Jessica Cuskelly](#)
Subject: Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application
Date: Sunday, 1 July 2018 8:01:04 PM
Attachments: [image001.png](#)

Hi Jessica

I would like to register my expression of interest for the above said project

My contact details are:

Steven Talbott

73 KIAH road gillieston Heights nsw 2321

0476893944

Kind regards

Amanda Heard

From: Jessica Cuskelly <jcuskelly@niche-eh.com>

Sent: Friday, 22 June 2018 12:16 PM

To: Clare Leever

Subject: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

To whom it may concern,

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Please be advised that your contact details have been provided by the NSW Office of Environment and Heritage (OEH) in accordance with Section 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents* as a potential Aboriginal stakeholder who may have interest in registering to the abovementioned project.

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Please see link below.

ShareFile Attachments	
Title	Size
4017_ACHA_Notification_RAP_Drft01_Karuah_20180622.pdf	216.5 KB
Download Attachments Jessica Cuskelly uses ShareFile to share documents securely. Learn More.	

Kind Regards,
Jess

Jessica Cuskelly BA (Hons)

Heritage Consultant

Sydney Head Office



Excellence in your environment

M 0488 224 968 **T** 02 9630 5658

A PO Box 2443 North Parramatta NSW 1750

E jcuskelly@niche-eh.com **W** niche-eh.com



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From: [Jessica Cuskelly](#)
To: "WIDESCOPE ."
Subject: RE: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application
Date: Friday, 29 June 2018 4:25:56 PM
Attachments: [image001.png](#)
[4017_ACHA_Notification_RAP_Drft01_Karuah_20180622.pdf](#)
[image002.png](#)
[image004.png](#)
[image006.png](#)

Afternoon Steven,

Thank you for your interest in the project, you have been registered and we will be in touch soon with further information. I have attached a pdf file for your interest and any further information will not be sent to you through ShareFile.

Have a great weekend,

Kind Regards,
Jess

Jessica Cuskelly BA (Hons)
Heritage Consultant
Sydney Head Office



Excellence in your environment

M 0488 224 968 T 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E jcuskelly@niche-eh.com W niche-eh.com

From: WIDESCOPE . [<mailto:widescope.group@live.com>]
Sent: Friday, 29 June 2018 4:15 PM
To: Jessica Cuskelly
Cc: Clare Leever
Subject: RE: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Hi Jessica

Thank you, please register my interest in the project I am a recognized cultural knowledge holder. I hold knowledge in determining Aboriginal Objects and Place,

Regards
Steven Hickey

Please note I am not able to access ShareFile Attachments

From: Jessica Cuskelly <jcuskelly@niche-eh.com>
Sent: Friday, June 22, 2018 12:16:51 PM
To: Clare Leever
Subject: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

To whom it may concern,

Re: Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW. Aboriginal Cultural Heritage Assessment and possible Aboriginal Heritage Impact Permit application

Please be advised that your contact details have been provided by the NSW Office of Environment and Heritage (OEH) in accordance with Section 4.1.2 of the *Aboriginal cultural heritage consultation requirements for proponents* as a potential Aboriginal stakeholder who may have interest in registering to the abovementioned project.

Niche Environment and Heritage has been commissioned by Tattersall Lander (the Proponent) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (hereafter referred to as the Subject Area) (see Figure 1). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period. The EIS will support a 'Designated Development' under Section 78A(8) of the *Environmental Planning and Assessment Act 1979 (EPA Act)*.

Please see link below.

ShareFile Attachments	
Title	Size
4017_ACHA_Notification_RAP_Drft01_Karuah_20180622.pdf	216.5 KB
Download Attachments Jessica Cuskelly uses ShareFile to share documents securely. Learn More.	

Kind Regards,
Jess

Jessica Cuskelly BA (Hons)
Heritage Consultant
Sydney Head Office



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E jcuskelly@niche-eh.com W niche-eh.com

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From: [Graeme Russell](#)
To: [Jessica Cusackly](#)
Cc: [Andrew Bond](#)
Subject: Proposed sand quarry at 4226 Nelson Bay Road Anna Bay NSW
Date: Friday 1 June 2018 10:47:55 AM
Attachments: [image007.png](#)
[image008.png](#)
[image009.png](#)

Hi Jess

Please be advised and accept this as confirmation of registration that the Worimi Conservation Lands Board of Management as a stakeholder registers its interest in the Proposed sand quarry at 4226 Nelson Bay Road Anna Bay NSW.

Kind regards



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B1.5 Section 4.1.6 notification of OEH and LALC

13 August 2018

Steven Cox
Senior Team Leader Planning
Hunter Central Coast Branch
Regional Operations Division
Office of Environment & Heritage
Locked Bag 1002
DANGAR NSW 2309

NSW 2324

Via email: steven.cox@environment.nsw.gov.au

Dear Mr Cox

Re: List of Registered Aboriginal Parties - Aboriginal Cultural Heritage Assessment for 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380).

I am writing to inform the Office of Environment and Heritage, as per Section 4.1.6 of the *Aboriginal cultural heritage consultation requirements for proponents 2010* that the following Aboriginal groups have registered for the above mentioned project:

- Didge Ngunawal Clan - Paul Boyd and Lilly Carroll
- Divine Diggers Aboriginal Cultural Consultants – Deirdre Perkins
- Karuah Indigenous Corporation – David Feeney
- Murra Bidgee Mullangari Aboriginal Corporation - Ryan Johnson, Darleen Johnson-Carroll
- Mur-Roo-Ma Incorporated – Bec Young
- Nur-Run-Gree Pty Ltd - Leonard Anderson
- Steve Talbott – Steve Talbott
- The Worimi Local Aboriginal Land Council – Andrew Smith
- Widescope Indigenous Group – Steven Hickey
- Worimi Local Aboriginal Land Council – Andrew Smith and Jamie Merrick
- Worimi Traditional Owners Indigenous Corporation – Candy Lee Towers

Also included with this letter is a copy of our letter of notification for Aboriginal people as identified in Stage 1, section 4.1.2 of the consultation process.

Yours sincerely



Jess Cuskelly
Heritage Consultant
Niche Environment and Heritage

PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 224 968
Email: jcuskelly@niche-eh.com

Tattersall Lander will write to each Aboriginal person or group whose details are provided to notify them of the proposed project and invite them to register an interest in the community consultation process. The Proponent's contacts details are: Tattersall Lander Pty Ltd, PO Box 580 Raymond Terrace NSW 2324, PH: 4987 1500

Yours sincerely



Caitlin Marsh
Heritage Consultant
Niche Environment and Heritage

B2 Stage 2 - Presentation of project information

20 August 2018

Dear Sir/Madam,

Re: 4017 - Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW – Project information and methodology for an Aboriginal Cultural Heritage Assessment under Section 4.2 and Section 4.3 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents* (2010)

Niche Environment and Heritage has been commissioned by Tattersall Lander (the Proponent) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (hereafter referred to as the Subject Area). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period. The EIS will support a 'Designated Development' under Part 4 of the Environmental Planning and Assessment Act 1979 (EPA Act).

The Proponent can be directly contacted on:

Tattersall Lander Pty Ltd
PO Box 580
Raymond Terrace NSW 2324

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents* (2010), please find enclosed the project information and methodology for the proposed assessment.

If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Areas or the Lachlan Region in general, please contact Niche Environment and Heritage as soon as possible. **The statutory time frame for commenting on the methodology closes at 5 pm, 18 September 2018.**

Please provide any cultural information you wish to share in a format you deem suitable and please don't hesitate to call and discuss any special requirements you may have regarding this information. Things you may wish to consider include:

- a. The nature of your cultural connection to the country on which the Subject Areas are located. Please include any relevant cultural knowledge.
- b. Whether you know of Aboriginal objects of cultural value to Aboriginal people within or in close proximity to the area of the proposed project, and
- c. Whether you know of any places of cultural value to Aboriginal people within or in close proximity to the area of the proposed project. This includes places of social, spiritual and cultural value,

historic places with cultural significance, and potential places/areas of historic, social, spiritual and/or cultural significance.

- d. If you have any contributions to how culturally appropriate information is gathered or the methodology for the assessment of cultural values
- e. cultural heritage management options for any objects, places or cultural values within the Subject Area

We are planning to conduct our archaeological field survey over one full day during the second part of the week of 17 September 2018, the exact date will be confirmed closer to the proposed time.

Registered Aboriginal Parties will need to **provide the following information prior the 18 September 2018** to be considered for any fieldwork:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Once we have finalised numbers for participation in the field survey we will begin to organise logistics such as time and meeting place.

In accordance to Section 3.4 of the consultation guidelines, the decision on who is engaged for delivering particular services is decided by the proponent and will be based on a range of considerations including skills, relevant experience, and providing necessary certificates of currency.

Please direct all correspondence to me at the contact details provided below:

Tattersall Lander
c/ Jess Cuskelly
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 224 968
Email: jcuskelly@niche-eh.com

Yours sincerely,



Balazs Hansel
Senior Archaeologist & Heritage Consultant
Niche Environment and Heritage



4226 Nelson Bay Rd, **Anna Bay, NSW**

Project Methodology Aboriginal Cultural Heritage Assessment

Tattersalls Lander Pty Ltd

20 August 2018

Document control

Project no.:	4017
Project client:	Tattersalls Lander Pty Ltd
Project office:	Head Office, Sydney
Document description:	Methodology and project information for 4226 Nelson Bay Rd, Anna Bay NSW
Project Director:	Renée Regal
Project Manager:	Balazs Hansel
Authors:	Balazs Hansel
Internal review:	Renée Regal
Document status:	Final
Local Government Area:	Port Stephens

Document revision status

Author	Revision number	Internal review	Date issued
Clare Leever	Draft REV01	Renée Regal	25/07/2018
Jessica Cuskelly	Draft Rev02	Balazs Hansel	9/08/2018
Jessica Cuskelly	FINAL	Balazs Hansel	13/08/2018

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Central Coast
Illawarra
Armidale
Newcastle
Mudgee
Port Macquarie
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Cover Image: View looking south at sand quarry area at 4226 Nelson Bay Road, Anna Bay NSW (Source: Niche, 2018).

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1. Introduction

1.1 Background and purpose of this document

Tattersall Lander (the proponent) has been requested to provide an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) to support a 'Designated Development' under Part 4 of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry (with ancillary manager's residence/site office) at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (see Figure 1 and Figure 2). There is an AHIMS registered Aboriginal site within the Subject Area that may be impacted by the proposed activity and therefore an Aboriginal Cultural Heritage Assessment (ACHA) is necessary to support an Aboriginal Heritage Impact Permit (AHIP).

This document presents a proposed methodology for the assessment of Aboriginal cultural heritage and will form part of the ACHA.

This proposed methodology has been designed to conform to the relevant requirements of various advisory documents and guidelines. These guidelines and documents include:

- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales* (OEH, 2011a).
- *Aboriginal Cultural Heritage Consultation Requirements for Proponents 2010 (Part 6 National Parks and Wildlife Act, 1974)* (DECCW, 2010a).
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010b) [hereafter referred to as the 'Code of Practice'.
- *The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance* (Australia International Council on Monuments and Sites [ICOMOS], 1999).
- *Aboriginal Cultural Heritage Standards and Guidelines Kit* (NSW National Parks and Wildlife Service, 1997).

1.2 Objective of community consultation

The objective of the community consultation is for Aboriginal people to have the opportunity to improve assessment outcomes by:

- Providing relevant information about the cultural significance and values of the Aboriginal object (s) and/or place(s) in or immediately adjacent to the Subject Area.
- Influencing the design of the method to assess cultural and scientific significance of Aboriginal object(s) and/or place(s).
- Actively contributing to the development of cultural heritage management options and recommendations for any Aboriginal object(s) and/or place(s) within the Subject Area; and
- Commenting on the draft assessment report before it is submitted to the government.

The presentation of this proposed project information should provide the opportunity for:

(a) The proponent to present the proposal, outline project details relevant to the nature, scope, methodology, and environmental and other impacts.

(b) The proponent to outline the impact assessment process including the input points into the investigation and assessment activities.

(c) The proponent to specify critical timelines and milestones for the completion of assessment activities and delivery of reports.

(d) The proponent and registered Aboriginal parties to clearly define agreed roles, functions and responsibilities.

(e) The Registered Aboriginal Parties to identify, raise and discuss their cultural concerns, perspectives and assessment requirements (if any).

The aim of this methodology is to facilitate a process whereby registered Aboriginal parties can:

(a) contribute to culturally appropriate information gathering and the research methodology,

(b) provide information that will enable the cultural significance of Aboriginal objects and/or places on the proposed project area to be determined, and

(c) have input into the development of any cultural heritage management options.

2. Project information

2.1 4226 Nelson Bay

Tattersalls Lander Pty Ltd (the proponent) seek an ACHA to inform an EIS to support a 'Designated Development' under Section Part 4 of the *Environmental Planning and Assessment Act 1979 (EPA Act)* prior to the construction of a sand quarry and ancillary manager's residence/site office at 4226 Nelson Bay Road, Anna Bay (Lot 591 DP 1191380). The location of the proposed project area lies within the Local Government Area (LGA) of Port Stephens and Local Aboriginal Land Council (LALC) of Worimi.

2.2 What is being proposed

The development project will involve the establishment of a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. This work will involve the excavation and relocation of sand which will disturb or destroy any existing stratigraphy, and may potentially harm Aboriginal objects that may exist within the Subject Area.

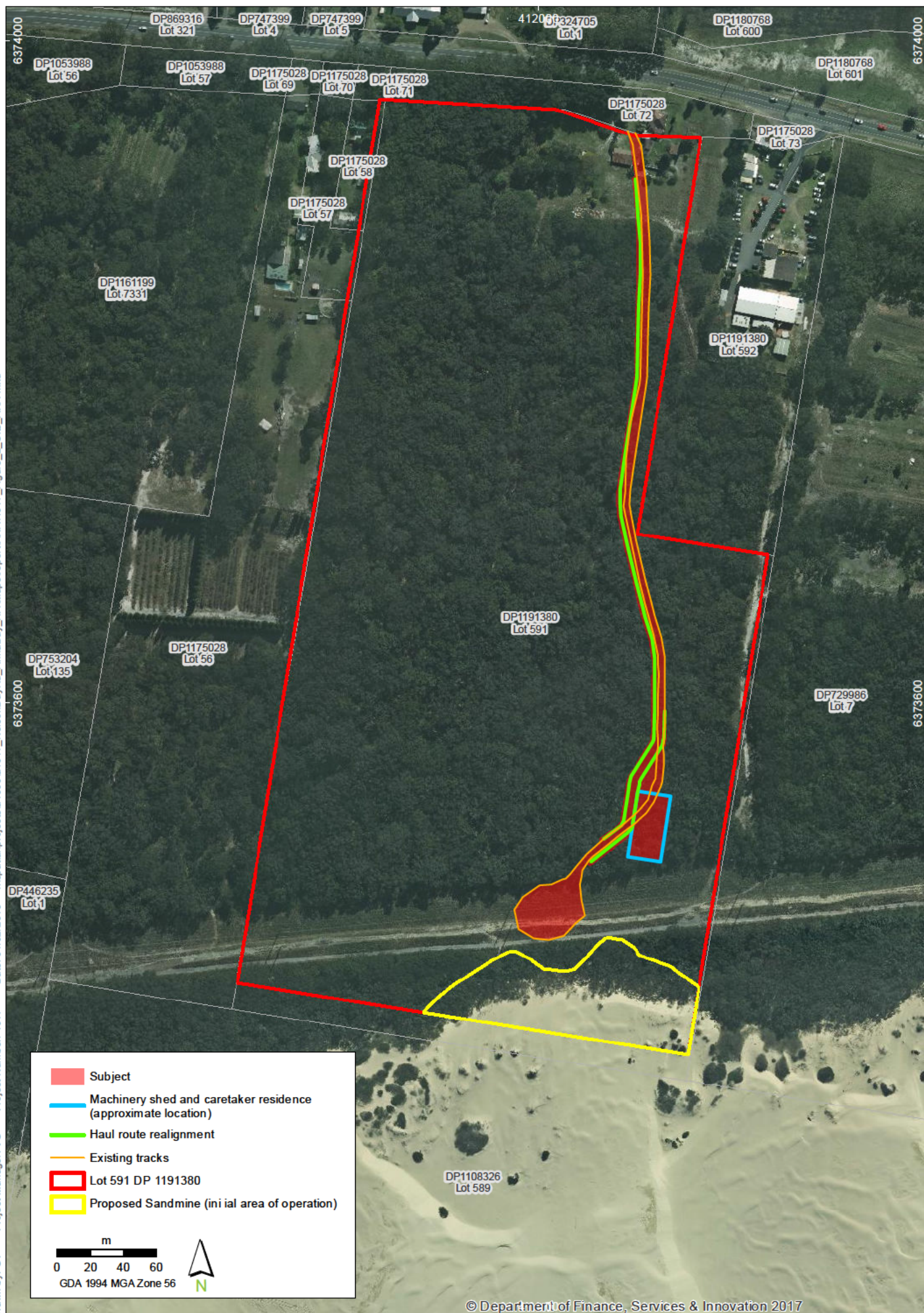
Ancillary development includes a manager's residence and site office within one building.

Drawn by: GT Project Manager: VG Project Number: 4017 Date: 22/01/2018 T:\spatial\projects\4000a4017_NelsonBayRd_Annab_Bay_HA\Map\report\AHAA4017_Figure_1_Location_AHA.mxd



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Subject Area

3. Existing cultural heritage knowledge

3.1 Historic context

The development of Anna Bay begins with the early history of the Port Stephens area. Port Stephens consists of the submerged estuary of the Myall and Karuah Rivers and inhabited by the *Worimi* and *Gringai* tribes of Aborigines. The Worimi comprised of a number of tribes including the Garuagal, Maiangal, Gamipingal, Garrawerrigal, Buraigal, Warringal, Birroongal, Birrimbai, Yerrungal and Wallamba (McCardle Cultural Heritage, 2015:16).

The Worimi people have been, and still remain the traditional custodians of a large area known as ‘Worimi country’. Worimi country was generally bounded by the four rivers: the Hunter River to the south, Manning River to the north and the Allyn and Patterson Rivers to the west, including the adjoining ocean and waterways. Within Worimi country there were 18 clan groups or ‘ngurras’, and spoke the Gathang language (McCardle Cultural Heritage, 2015:17). The Worimi people have occupied the area for thousands of years and have a strong cultural connection, as the area is still utilised for fishing and recreational activities by the Worimi people (McCardle Cultural Heritage, 2015:17).

The area was a rich resource, with direct access to marine (both ocean and estuarine), forest and stone resources from the neighbouring headlands. The history of the Worimi people and the connection with the area is abundantly evident in the extent and diversity of the cultural material present throughout the adjoining areas. For example, spears used for fishing were made from the flowering stem of the Grass Tree or Gynea Lily, with prongs of ironbark used on the tips. The Worimi used the beaches to travel between Nelson Bay to the north and Stockton to the south (McCardle Cultural Heritage, 2015:14). The Stockton Beach Dune System is the largest mobile dune in coastal Australia and represents an important area of cultural heritage (OEH, 2004).

The Worimi Country can be mapped archaeologically and with traditional knowledge of areas/sites including sacred sites, meeting places, burial ground(s), and travel routes of a large society. There has been a considerable amount of archaeological investigation and reporting throughout the area, with large numbers of sites identified. Dean-Jones (1990, 1992) and Umwelt (2000) have done extensive work in the Worimi Conservation Land. Investigations of a smaller section of the area were Comber (1990) and ERM (1995, 2001). Additionally, Umwelt (1997), Hall (1928), MCH (2004, 2005) and Dyll (2004) have conducted archaeological investigations at Birubi Point.¹

Shell middens are quite extensive in the area, with shell deposits consisting predominately of pipi (*Plebidonaz deltoids*) shell. Some also contain mud whelk (*Pyrazus ebininus*) and cockle (*Anadara trapezia*) shells; stone artefacts, bird, fish and animal bones (McCardle Cultural Heritage, 2015:17). Additionally, burial sites are recorded within the Worimi Conservation Land and are difficult to predict within the landscape.

Following the initial period of dune formation and mobility between 6,000 and 4,500 years ago, there have been periods in time when the dunes have been stable. During these periods of prolonged stability, the dunes were vegetated. After each period of stability, mobile dunes developed and buried the vegetated dunes.

¹ References were taken from McCardle Cultural Heritage, 2015:17)

Although limited information is available, when combined with oral testimony and archaeological evidence, the Worimi people prospered within the environment. Sites including shell middens, artefact scatters, hearths, sacred sites, burials and Coorobori grounds demonstrate the extensive utilisation of the area.

3.2 Historic accounts

In April 1770, James Cook sighted the Port and named it in honour of Sir Phillip Stephens, Secretary to the Admiralty, noting in his log book that it appeared “to be sheltered from all winds” and that “there might be a sufficient depth for shipping water in the bay” (NSW Education, unknown:1).

Port Stephens was not entered by Europeans until late 1871 when the ‘Salamander’, docked, transporting convicts to Sydney. It appears that the earliest Europeans to live in the area were five escaped convicts, wrecked at Port Stephens in 1790 (McCardle Cultural Heritage 2015:18). The Worimi, were extremely accommodating taking them into their tribe (McCardle Cultural Heritage 2015:19). Five years later they were ‘rescued’ by Captain W.R. with the Reliance and Supply.

In 1797, Lieutenant John Shortland sailed the narrow inlet around 30km to the south of Port Stephens, finding coal. The settlement of Newcastle soon followed, on Port hunter, initially a convict settlement. By 1822 the town was prospered as free settlement and became the gateway to the Hunter Valley (NSW Education, unknown: 2).

In 1830 a historical account by Robert Dawson described the Worimi Tribe as “utilising spears and shields, wearing belts of opossum fur and using combs formed from the leg bones of kangaroos” (Dawson, 1830:115 in McCardle Cultural Heritage, 2015:17).

Much of the land has changed drastically since 1788, and dispossession has had significant impacts on Worimi people and their culture.

3.3 Aboriginal Heritage Information Management System (AHIMS)

A search of the Aboriginal Heritage Information System (AHIMS) was undertaken on 7 November 2017 (AHIMS Client ID #311311). A total of 105 Aboriginal sites and one Aboriginal place were identified within a 22 km² search area (see Figure 3). One Aboriginal site, known as ‘NBRd 4’ comprising shell fragments (AHIMS ID#38-5-0320) is located within the Subject Area. Another Aboriginal site, known as ‘NBR3/PAD4’ comprising a Potential Archaeological Deposit (PAD) (AHIMS ID#38-5-0325) is situated on the north-west corner of the Subject Area potentially extending into the Subject Area.

Table 1: Results of the AHIMS search collated by site feature

Site features	Total
Aboriginal Resource and Gathering	14
Artefact/Isolated find	2
Artefact Scatter	13
Artefact and Shell	3
Artefacts/Open Camp Site	1
Burial(s)	2
Habitation Structure	2

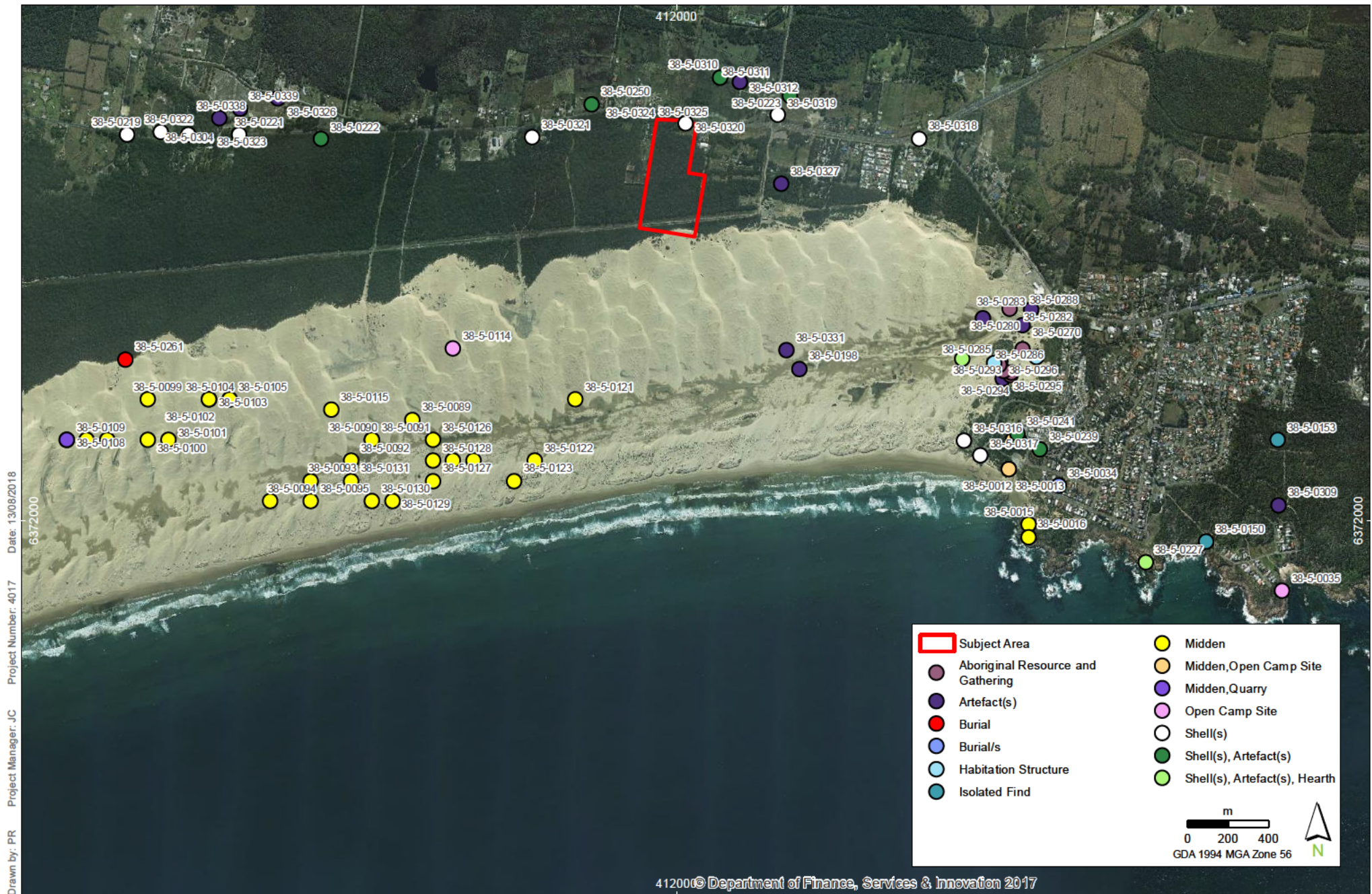
Potential Archaeological Deposit (PAD)	6
Shell Midden	50
Shell Midden/Artefact(s)	7
Shell Midden/Artefact(s)/Hearth	1
Shell Midden/Open Camp Site	2
Shell Midden/Quarry	1
Restricted	1
Total	105

The Subject Area is located in the Coastal Zone of the Hunter Valley, in particular, it is situated within the Outer Holocene Barrier and sand dunes. The resources in this area would have been well established by Aboriginal people in the past, but modifications including residential developments are likely to have disturbed areas containing archaeological materials. The Outer Holocene Barrier have stable dunes and the potential to contain stratified deposits dating back to 4,500PB (Dean-Jones 1992).

The Stockton Bight is a unique coastal embayment and a well preserved example of a dual barrier system close to the major metropolitan centres of Newcastle and Sydney (Australian Heritage Database). The Newcastle Bight has some of the largest Midden sites in NSW as well as burial and educational sites (Australian Heritage Database). The barrier dune system of the Stockton Bight is 31km long and ranges from one to two kilometres in width (Eric Martin and Associates, 2002:33). The stabilised dunes are transgressive that overrode the strand plain during the Holocene (Eric Martin and Associates, 2002:33).

The frequencies of site types within the search area are consistent with regional trends identified during previous studies within close proximity to the current assessment. Sites are variable distances from permanent water sources throughout the search area, with the majority (of those located in proximity to the Subject Area) located approximately 1km from the ocean and approximately 2.5km from Tilligerry Creek (Figure 3).

The most common site type in the surrounding area are shell middens with only shell, followed by Aboriginal Resource Gathering sites and artefact scatters (see Table 1).



3.4 Previous archaeological assessments of the Subject Area

3.4.1 Dean-Jones (1990)

The most significant study carried out in the Newcastle Bight was carried out by Pam Dean-Jones. Although the hard copy could not be accessed among the archaeological literature. Dean-Jones (1990) identified numerous sites across the Port Stephens geomorphic zone.

3.4.2 Eric Martin and Associates (2002)

A Conservation Management Plan (CMP) was commissioned by the NSW National Parks and Wildlife Service (NPWS) in 2002 to provide a basis for the ongoing conservation and management of Tomaree Head. Tomaree Head is situated at the southern entrance to Port Stephens and is of significance to Aboriginal people. The CMP concludes that the NPWS as the custodian and landlord of Tomaree, is responsible for the conservation, management of Tomaree Head, and to increase public access to it as a state significant prominent landmark with WWII fortifications,.

3.4.3 McCardle Cultural Heritage (2015)

A due diligence assessment of 781 Marsh Rd, Port Stephens was undertaken by McCardle Cultural Heritage in 2015. It included both a desktop assessment and a field survey (which included the Subject Area). The subject area was situated within a floodplain and was assessed as having low sensitivity due to clearing and past land use impacts.

3.4.4 McCardle Cultural Heritage (2015)

Additionally McCardle Cultural Heritage (2015) conducted a Salvage AHIP excavation at 108 Nelson Bay Rod, Bobs Farm to Anna Bay (Cromarty Lane to Port Stephens Drive). They concluded that the archaeological evidence recovered from within the study area, can be interpreted in relation to the traditional way of life that was practiced by Aboriginal people. They also concluded that site 38-5-0310 was extremely complex with numerous locations with few pieces of shell with high stone artefact densities.

3.4.5 Niche (2017)

A field survey of the Subject Area was undertaken by Niche in 2017 and forms part of the ongoing assessment of this report. The area contains landscape features which suggest a potential for archaeological deposits (proximity to a waterway and containing a ridgeline within 200 m of waters).

3.4.6 OEHL, Board of Management for the Worimi Conservation Lands

In 2015, the Plan of Management was jointly adopted by the Minister of the Environment and the Minister for Lands and Water. The report was prepared by the Board of Management for the Worimi Conservation Lands with staff of the Lower North coast Region of the NPWS.

3.5 Predictive model

Detailed predictive modelling has been developed for the area utilising data from archaeological, geological and geomorphic research. Previous archaeological studies undertaken throughout the area provide a good indication of site types and site patterning in the area. These studies have shown that shell middens associated with stone artefacts and middens with only shell fragments are the most predominate site types within the area. The most common site location is the seaward area of active transgressive dunes/ active blowout. This is then followed by the beach foredune and outer basin (Eric Martin and Associates, 2002:34).

The Subject Area lies in the Outer Holocene barrio and sand dunes. These dunes are stable and the potential to contain stratified deposits dating back to 4,500 BP (Dean-Jones 1992).

The general predictions and key trends are listed below:

- The most common site types are open sites containing shell with artefacts, followed by isolated finds.
- Sites are usually located within 50 metres of reliable water source.
- Sites are located both on the Holocene and Pleistocene dunes overlooking the interbarrier depression.
- Sites are not usually found in the interbarrier depression.
- Site types are predominately shell middens, stone tools and may also contain charcoal.
- Artefact scatters, isolated finds, scarred trees, burials and ceremonial sites may also be found along the dunes.
- Larger sites with higher densities of artefacts are more likely to be found close to stream confluences and permanent water sources, such as Tillegerry Creek (approximately two kilometres from the Subject Area).
- Artefacts typically date to the Holocene.
- Both middens (including estuarine shell species, rock oysters and mud whelk) and open camp sites are located on the inner landward margin of the Holocene dunes.
- Stone artefact types include flakes, flaked pieces, broken flakes, cores and tools.
- Artefact scatters are most commonly linked in close proximity to permanent water sources including creeks, swamps, the inter barrier depression and the coast.
- Frequency and density of artefacts are directly related to location within the landscape.
- Large sites increase markedly with proximity to permanent water sources.
- The majority of sites will be subject to disturbances including human and natural.
- High concentrations of artefacts are more likely to be located within resource rich areas.

A site specific predictive model was developed and is described below. This predictive model has been developed based on a review of landscape context and individual landforms, ethno historical evidence of traditional land use, distribution of natural resources, the results of previous archaeological work in the vicinity of the study area and the predictive modelling proposed in previous investigations.

- Shell artefacts and stone artefacts will be the most common site type across the landscape and are the most likely site type to occur within the Subject Area.
- Sites will most commonly be low density open artefact scatters or isolated finds, although high density scatters may also be present.
- Artefact sites can be found across environmental contexts, but are most easily identified where vegetation is limited and ground surface is visible.
- Stands of remnant old growth vegetation retain the potential for scarred trees to be present but large scale land clearance of the area in general means that such stands are rare.
- The majority of sites will be predominated by tuff obtained locally and and/or silcrete, chert or quartz that have been traded/transported from the Hunter Valley area.
- Relatively undisturbed soils have potential to contain subsurface archaeological deposits.
- The potential for intact deposits is not necessarily completely destroyed by ploughing of an area, as this generally only affects the top 30 cm of soil.

- Excavations within the region suggest that high densities of artefacts are present around 50 m from water sources, and that subsurface material may be much greater than indicated by surface numbers of artefacts.
- The following site types are **unlikely** to occur in the Subject Area:
 - o Stone quarry sites, axe grinding grooves, stone engravings/art and shelter sites due to the lack of suitable geology.
 - o Scarred or carved trees due to the extent of vegetation clearing in the region.
 - o Burials and ceremonial sites (including stone arrangements) given the environmental conditions, and disturbances. Burial sites can occur anywhere but generally in significant landform locations and generally inhumations in soft soils.

4. Proposed methodology for cultural heritage assessment

4.1 Aboriginal Cultural Heritage Assessment (ACHA)

The Aboriginal cultural heritage assessment will follow the guidelines set out in the:

- *Aboriginal cultural heritage consultation requirements for proponents 2010*
- *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales*
- *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in New South Wales.*

The ACHA will:

- Synthesise the results of technical investigations.
- Include an assessment of significance of any Aboriginal objects or Aboriginal cultural heritage values identified.
- Include an impact assessment and provide management and mitigation measures to inform any AHIP application as required, and
- Detail community consultation process and any Aboriginal cultural heritage values identified, in compliance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* guidelines.

The ACHA will follow the general methodology described by the tasks below:

- **Desktop assessment** - Some of this work has already been completed by Niche (2017). To avoid repeating previous work, as much information as possible would be incorporated into the Aboriginal Cultural Heritage Assessment Report (ACHAR) and Archaeological Report (AR).
- **Survey** - A comprehensive site survey would be undertaken by Niche along with representatives from the Registered Aboriginal Parties (RAPs).
- **Reporting** - A draft report that satisfies the requirements of the Code of Practice (DECCW, 2010a), the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010b) and the *Guide to Investigating, Assessing and Reporting on Aboriginal Cultural Heritage in NSW* (OEH, 2011) will be prepared.

4.2 Aboriginal community input points for the assessment process

The DECCW (2010b) *Aboriginal cultural heritage consultation requirements for proponents 2010* suggest a number of points during the ACHA for input from RAPs including:

- During Stage 1 – Notification of project proposal and registration of interest
- During Stage 2 - Presentation of information about the proposed project (this methodology).
- During Stage 3 - Gathering information about cultural significance (this methodology).
- During fieldwork.
- During Stage 4 - Review of draft cultural heritage assessment report.

In addition to this, any input and suggestions into the project (or the consultation process itself) up to the end of the commenting period of Stage 4 is welcomed. Unless it becomes clear during the process of the assessment that they are required, no specific meetings (other than during fieldwork) have been included for this assessment.

4.3 Archaeological and Cultural Heritage Survey

The purpose of this section is to describe the method to conduct an archaeological survey. The aim of the survey is to inspect the impact footprint of the Subject Area and try to identify and ground-truth any

Aboriginal site that is already registered, and also to identify Aboriginal sites that may be present within the Subject Area. It also aims to provide further information on the Aboriginal cultural heritage values of the Subject Area. The survey team will walk the entire Subject Area in transects and record all data in accordance with the Code of Practice as listed below.

- Recording all transects on pro formas, relevant information includes the GPS coordinates of the start and finish of each transect, landform type, existing environment and level of disturbance.
- Photographic recording of all landforms, disturbance type and surface features relevant to each transect.
- Flagging and recording the location of artefacts and features using a hand held non-differential GPS unit.
- Photographic recording of the location and surroundings of flagged artefacts and features.
- Recording every identified archaeological site on pro formas, including details such as a written description, photographic recording, a sketch of the context of the recorded site and extent using a hand held non-differential GPS unit.

4.4 Sensitive cultural information – management protocol

During the consultation process Tattersall Lander Pty Ltd and Niche will provide the opportunity for RAPs to provide cultural information, including a statement of the value to identified sites and other matters. The input points for this have been listed in Section 4.2, information however will be accepted up to the end of the commenting period of Stage 4 or prior to the finalisation of the ACHA report.

Please be aware that Tattersalls Lander Pty Ltd and Niche staff may seek cultural information and supporting evidence in regard to matters of cultural value.

In the event that your or your organisation has sensitive or restricted public access information it is proposed that Tattersall Lander Pty Ltd will manage this information (if provided by the Aboriginal community) in accordance with a sensitive cultural information management protocol. It is anticipated that the protocol will include making note of and managing the material in accordance with the following key limitations as advised by Aboriginal people at the time of the information being provided:

- Any restrictions on access and material
- Any restrictions on communication of the material (confidentiality)
- Any restrictions on the location/storage of the material
- Any cultural recommendations on handling the material
- Any names and contact details of persons authorised within the relevant Aboriginal group to make decisions concerning the Aboriginal material and degree of authorisation
- Any details of any consent given in accordance with customary law
- Any access and use by the RAPs of the cultural information in the material.

Please consider the above list when providing your recommendations regarding any culturally sensitive information.

4.5 Critical timelines

Critical timelines for the ACHA are outlined in Table 2. Please note that some of these timeframes are estimates at this stage in the process and are provided to allow forward planning of personnel and resources.

Table 2: Critical timelines for the 4226 Nelson Bay Rd, Anna Bay ACHA

Project item	Due date
Provision of comments on the proposed methodology (this document)	Within 28 days from delivery of this document starting on the 20 August 2018. Comment period will end on 18 September 2018.
Archaeological survey	One day during the week starting on 17 September 2018
Provision of the draft ACHA report (including the proposed management and mitigation measures) to registered Aboriginal stakeholders for review.	Within two weeks of the completion of the field survey at the end of September 2018. Should the field survey confirm that additional investigation in the forms of test excavation needed, this time frame would change accordingly.
Provision of comments on draft ACHA report	Within 28 days from delivery of the draft report, during October 2018.
Collation of cultural significance information	Ongoing throughout the process until end of the draft ACHA report review period.
Finalisation of the ACHA report in consideration of comments received	Generally within one week of the draft report comment deadline early to mid-November 2018.

4.6 Who to contact

If you would like to provide information for the ACHA, or if you would like to otherwise discuss the project please do not hesitate to contact:

Tattersall Lander Pty Ltd
c/o
Balazs Hansel
Senior Archaeologist
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750
T: 0488 224 300
E: bhansel@niche-eh.com

References

- Australia ICOMOS. (2013). *The Australia ICOMOS Charter for Places of Cultural Significance - The Burra Charter*. Australia International Council on Monuments and Sites [ICOMOS].
- McCardle Cultural Heritage. (2015). *781 Marsh Rd, Bobs Farm, Aboriginal due diligence assessment*. Sydney: Prepared for Telstra.
- McCardle Cultural Heritage. (2015). *Volume 1 MR 108 Nelson Bay Rd, Bobs Farm to Anna Bay Stage 2- Cromarty Lane to Port Stephens Drive. Archaeological Salvage AHIP 1132063*. Sydney: Prepared for Roads and Maritime.
- OEH. (2015). *Worimi Conservation Lands Plan of Management*. Sydney. Office of Environment and Heritage.
- Eric Martin and Associates. (2002). *Tomeree Head, Conservation Management Plan*. Sydney: Prepared for NSW National Parks and Wildlife Service.
- NSW Education. (unknown). *A Brief History of Anna Bay and its School*. [Online] at <http://www.annabay-p.schools.nsw.edu.au/documents/31694767/31702034/A%20BRIEF%20HISTORY%20OF%20ANNA%20BAY%20AND.pdf>
- Office of Environment and Heritage [OEH] . (2011). *Guide to investigating, assessing and reporting Aboriginal cultural heritage in NSW: Part 6 National Parks and Wildlife Act 1974*. Office of Environment and Heritage.
- OEH. (2004). Stockton Beach Dune System [Online] at <https://www.environment.nsw.gov.au/heritageapp/ViewHeritageItemDetails.aspx?ID=2280081>
- Department of Environment, Climate Change and Water NSW [DECCW] . (2010b). *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales: Part 6 National Parks and Wildlife Act 1974*. Department of Environment, Climate Change and Water NSW.
- Department of Environment, Climate Change and Water NSW [DECCW]. (2010a). *Aboriginal cultural heritage consultation requirements for proponents 2010: Part 6 National Parks and Wildlife Act 1974*. Department of Environment, Climate Change and Water NSW.
- NSW National Parks and Wildlife Service. (1997). *Aboriginal Cultural Heritage Standards and Guidelines*. NSW National Parks and Wildlife Service.
- Office of Environment and Heritage [OEH] . (2011). *Guide to investigating, assessing and reporting Aboriginal cultural heritage in NSW: Part 6 National Parks and Wildlife Act 1974*. Office of Environment and Heritage.

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

Head Office

Niche Environment and Heritage

PO Box 2443 North Parramatta NSW 1750

Email: info@niche-eh.com

All mail correspondence should be through our Head Office

B3 Stage 3 - Gathering information about the cultural significance of the Subject Area

B3.1 Assessment methodology

08 March 2019

Dear Sir/Madam,

Re: 4017 - Proposed sand quarry at 4226 Nelson Bay Road, Anna Bay NSW – Project information and methodology for an Aboriginal Cultural Heritage Assessment under Section 4.2 and Section 4.3 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents* (2010)

Niche Environment and Heritage has been commissioned by Tattersall Lander (the Proponent) to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay (hereafter referred to as the Subject Area). The Subject Area backs onto the Newcastle Bight sand dune system. The proposed quarry will extract a maximum of 50,000 cubic metres of sand in a year over a 30 year period. The EIS will support a 'Designated Development' under Part 4 of the Environmental Planning and Assessment Act 1979 (EPA Act).

The Proponent can be directly contacted on:

Tattersall Lander Pty Ltd
PO Box 580
Raymond Terrace NSW 2324

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage *Aboriginal cultural heritage consultation requirements for proponents* (2010), please find enclosed the project information and methodology for the proposed test excavation assessment.

If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. **The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.**

Please provide any cultural information you wish to share in a format you deem suitable and please don't hesitate to call and discuss any special requirements you may have regarding this information. Things you may wish to consider include:

- a. The nature of your cultural connection to the country on which the Subject Area is located. Please include any relevant cultural knowledge.
- b. Whether you know of Aboriginal objects of cultural value to Aboriginal people within or in close proximity to the area of the proposed project.
- c. Whether you know of any places of cultural value to Aboriginal people within or in close proximity to the area of the proposed project. This includes places of social, spiritual and cultural value, historic places with cultural significance, and potential places/areas of historic, social, spiritual and/or cultural significance.

- d. If you have any contributions to how culturally appropriate information is gathered or the methodology for the assessment of cultural values.
- e. Cultural heritage management options for any objects, places or cultural values within the Subject Area.

We are planning to conduct our archaeological test excavation over three days during April/May 2019, the exact date will be confirmed closer to the proposed time.

Registered Aboriginal Parties will need to **provide the following information prior to 8 April 2019** to be considered for any fieldwork:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual to participate in test excavations.

Once we have finalised numbers for participation in the field survey we will begin to organise logistics such as time and meeting place.

In accordance to Section 3.4 of the consultation guidelines, the decision on who is engaged for delivering particular services is decided by the proponent and will be based on a range of considerations including skills, relevant experience, and providing necessary certificates of currency.

Please direct all correspondence to me at the contact details provided below:

Tattersall Lander
c/ Dr Morgan Disspain
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 774 566
Email: mdisspain@niche-eh.com

Yours sincerely,



Dr Morgan Disspain
Senior Archaeologist & Heritage Consultant
Niche Environment and Heritage

B3.2 Responses to project information and assessment methodology

Samuel Ward

From: Jessica Cuskelly
Sent: Friday, 7 September 2018 12:45 PM
To: Balazs Hansel
Subject: FW: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information
Attachments: Niche - Anna Bay response.docx; COFC 2018-19.pdf; Workers Comp 2017-2018.pdf

From: Anthony Anderson [mailto:murroomainc1@gmail.com]
Sent: Thursday, 6 September 2018 2:15 PM
To: Jessica Cuskelly
Subject: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Hi Jess-

Please find enclosed Murrooma Response to ACHA/Methodology- Anna Bay.
I have also attached our current insurances.

Consultant and Availability:
Bec Young will be available for the Survey (the week of the 17th Sept)
Wednesday 19th and Friday 21st of Sept if that suits?

Thanks
Bec Young

--

Anthony Anderson
CEO Mur-roo-ma Incorporated
Justice of The Peace

This email has been scanned for spam and viruses by Proofpoint Essentials. Click [here](#) to report this email as spam.



9 Vardon Road Fern Bay 2295 NSW
49281910
0402827482

ABN: 97 807 719 484

6th of September 2018

Tattersall Lander

c/ Jess Cuskelly

Niche Environment and Heritage

Re: Proposed Sand Quarry at 4226 Nelson Bay Road, Anna Bay NSW

To Jess,

Murrooma have read and fully understand the ACHA/Methodology for the proposed Sand Quarry at Anna Bay.

Murrooma has completed a due diligence of this proposed project area with Niche – Vicki Gordon previously, we discussed some recommendations whilst onsite. This included a Cultural Heritage Management Plan that is put in place in line with all other Sand Quarries within the Worimi area.

Anthony Anderson and Bec Young are representatives of Murrooma who both hold specific cultural knowledge and education relevant to determining the significance of Aboriginal objects and places in the Port Stephens/Anna Bay region. We are both Traditional Custodians of the Worimi area and are in a position to speak for country.

The project area is located close to a noted Aboriginal Place and this area and surrounding areas are very significant to our local Aboriginal people. There are many places within this area that have significant cultural value to Worimi people and are in close proximity to the proposed project. These places of social, spiritual and cultural value are traditional areas with direct linkage to our ancestors and storylines.

We have previously been involved in the extensive salvage (Salvage AHIP excavation at 108 Nelson Bay Road, Bobs Farm to Anna Bay- McCardle Heritage) directly across the road from this proposed development and we believe that the midden material outlined in the AHIMS search (AHIMS ID#38-5-032) may be a continuation of this previous salvaged site.

We agree with the methodology for the archaeological and cultural heritage survey assessment and Murrooma will be able to discuss cultural values and collection of information further onsite.

We believe that in order to gain the specific information that will be required for this area, it must be sorted through Local Knowledge Holders and this is what we can offer in the consultation or engagement process.

Thankyou

Rebecca Young- Operations Manager

Anthony Anderson- CEO

From: [Ryan Johnson](#)
To: [Jessica Cuskelly](#)
Cc: [Balazs Hansel](#)
Subject: acha - methodology 4226 Nelson Bay road, Anna Bay
Date: Tuesday, 21 August 2018 10:22:26 PM
Attachments: [murra bidgee public liability 2018.pdf](#)
[murra Bidgee workers compensation current.pdf](#)

Hi Jess,

I have read the project information ACHA and methodology for the above project and endorse the recommendations made by Niche. My family and members have a long history in the Anna Bay area, my grandfather resided in Anna Bay for over 10 years, our contact person for this project would be Ryan 0475565517 or Shaun 0400637554. Please see attached insurances.

Kind regards

Ryan Johnson | **Murra Bidgee Mullangari**



Aboriginal Corporation Cultural Heritage

A: PO Box 246, Seven Hills, NSW, 2147
E: murrabidgeemullangari@yahoo.com.au
ICN: 8112

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Samuel Ward

From: Worimi TOC <worimitoc@hotmail.com>
Sent: Monday, 17 September 2018 1:41 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information
Attachments: [REDACTED]

Hi Balazs,

Please find attached current certificates of insurance.
Site officer who will attend the field inspection will be myself, my details are below.

The subject areas 4226 Nelson Bay Road, Anna Bay NSW, is culturally significant to the Worimi Tribe as this area is located not too far from the shore line. I could identify that the Worimi people would have used this area for generations. I have not inspected the area personally but the area does tell me that there is a lot of potential for Aboriginal objects to be present. Also members of Worimi TOIC claim the area to be significant to Worimi people.

Cheers,

Candy Towers
Site Officer
Worimi Traditional Owners Indigenous Corporation
Ph: 0412 475 362
e: worimitoc@hotmail.com



WORIMI TOIC

Guudji Yiigu, I am a Worimi and Yorta Yorta woman from Newcastle NSW, I acknowledge and pay my respects to the traditional owners and custodians of the land on which I live and work, to their continuing connection to land, water, culture and community and pay my respects to the Elders past, present and to our future generations.

From: Balazs Hansel
Sent: Friday, 14 September 2018 11:18 AM
To: Balazs Hansel
Cc: Jessica Cuskelly
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information
[Dear All,](#)

Samuel Ward

From: Sites <Sites@worimi.org.au>
Sent: Monday, 17 September 2018 8:54 AM
To: Balazs Hansel
Subject: Proposed Sand Quarry
Attachments: COC Public Liability.pdf; Workers Comp.pdf

Hi Balazs Worimi agrees with the methodology and would like to register our interest in the project please [see](#) the attachments

Kind Regards,

Jamie Merrick
Senior Sites Officer
Worimi Local Aboriginal Land Council
2163 Nelson Bay Road,
WILLIAMTOWN NSW 2318

Ph: 02) 4033 8814 | Fax: 02) 4033 8899
Email: sites@worimi.org.au



Samuel Ward

From: WIDESCOPE . <widescope.group@live.com>
Sent: Friday, 14 September 2018 6:17 PM
To: Balazs Hansel
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Attachments:

Hi Balazs,

Thank you, I have reviewed and support the Methodology Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3

Please see Insurances attached

Contact Donna Hickey (Admin) 0425232056

Nominated Individual Steven Hickey 0425230693

Thank you
Steven Hickey

From: Balazs Hansel
Sent: Friday, September 14, 2018 11:18:41 AM
To: Balazs Hansel
Cc: Jessica Cuskelly
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information
Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Please be advised that the fieldwork might be pushed back by a week given that we still waiting on response for the methodology.

Please do not hesitate to contact us should you have any questions or discussing the project further.

Regards,

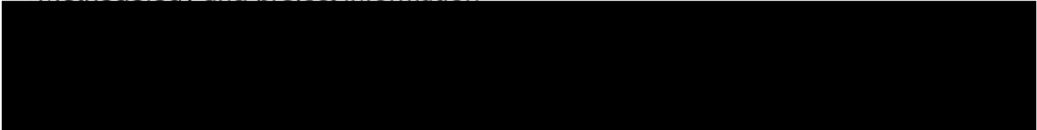
BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant
Sydney


niche
Environment and Heritage

Samuel Ward

From: lennie.anderson011 lennie.anderson011 <lennie.anderson011@bigpond.com>
Sent: Friday, 14 September 2018 4:07 PM
To: Balazs Hansel
Subject: Re: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Attachments:



Hello,

Wasn't sure if our offices had passed on the information you required?

We have read the Methodology agree with it's recommendations etc, but would like to discuss some finer points onsite, as persons not engaged on the proposal can and will read any statements and utilize for their own intelligence gathering outside of the Project!

The Representatives of this Company Are: Myself, Chris Collison, Caitlin Moran (which ever is available owing to other work commitments) All correspondence is to be forwarded to me.

Please find attached insurances as requested. If any difficulties please contact me!

Thanking You

Lennie Anderson OAM
Nur-Run-Gee Pty Ltd (Director)

----- Original Message -----

From: "Balazs Hansel"
To: "Balazs Hansel"
Cc: "Jessica Cuskelly"
Sent: Friday, 14 Sep, 2018 At 11:18 AM
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Samuel Ward

From: David Feeney <karuahindigenous@outlook.com>
Sent: Tuesday, 25 September 2018 4:37 PM
To: Balazs Hansel
Subject: RE: Nelson Bay Road 4226 (our ref.4017)

Hi Balazs;

The Project Methodology for 4226 Nelson Bay Road,
Anna Bay
Aboriginal Cultural Heritage Assessment is all good what I have read

Thank you

Dave Feeney
Karuah Indigenous Corporation
0421114853

Sent from [Mail](#) for Windows 10

From: Balazs Hansel
Sent: Tuesday, September 25, 2018 1:45:59 PM
To: 'David Feeney'
Subject: RE: Nelson Bay Road 4226 (our ref.4017)
[Hi David,](#)

[Sorry for that. Could you please let me know your contact number and I'll give you a call.](#)

[Regards,](#)
[Balazs](#)

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant
Sydney



Excellence in your environment

M 0488 224 300 T 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E bhansel@niche-eh.com W niche-eh.com



From: David Feeney [mailto:karuahindigenous@outlook.com]
Sent: Tuesday, 25 September 2018 1:38 PM
To: Balazs Hansel
Subject: RE: Nelson Bay Road 4226 (our ref.4017)

Hi Can not down load file

Sent from [Mail](#) for Windows 10

From: Balazs Hansel <bhansel@niche-eh.com>
Sent: Monday, September 24, 2018 2:19:17 PM
To: 'David Feeney'
Subject: RE: Nelson Bay Road 4226 (our ref.4017)

Dear Dave,

In addition to my previous email, could you please send through your certificate of currency for Public liability insurance and also the copy of your workerscomp as well?

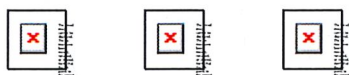
Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant
Sydney



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M 0488 224 300 T 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E bhansel@niche-eh.com W niche-eh.com



From: Balazs Hansel
Sent: Monday, 24 September 2018 1:53 PM
To: 'David Feeney' <karuahindigenous@outlook.com>
Subject: RE: Nelson Bay Road 4226 (our ref.4017)

Dear Dave,

The pdf you are having problem to open is just a logo. Please find the two documents you need to read attached again. Please note that the period for commenting has already been closed so please let us know your feedback asap.

Regards,

BALAZS HANSEL MA(Arch) MA(Hist)

Senior Heritage Consultant
Sydney



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M 0488 224 300 T 02 9630 5658

A PO Box 2443 North Parramatta NSW 1750

E bhansel@niche-eh.com W niche-eh.com



From: dave.feeney@bigpond.com [<mailto:dave.feeney@bigpond.com>]

Sent: Monday, 17 September 2018 9:45 AM

To: Jessica Cuskelly

Subject: Nelson Bay Road 4226

Hi Balazs;

I can not open 9.55KB doc can you please send as Word

Thank you

Dave Feeney
Karuah Indigenous Corporation
0421114853

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Samuel Ward

From: Deidre Perkins <dedemaree3@hotmail.com>
Sent: Friday, 14 September 2018 11:31 AM
To: Balazs Hansel
Subject: Methodology
Attachments: 

I will be doing the work and my contact number is 0425654290.

Thanks
DeidrePerkins

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Samuel Ward

From: Deidre Perkins <dedemaree3@hotmail.com>
Sent: Friday, 14 September 2018 11:22 AM
To: Balazs Hansel
Subject: Re: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Sorry for the delay,
All seem good with me to go ahead.
DeidrePerkins

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From: Balazs Hansel
Sent: Friday, September 14, 2018 11:18:41 AM
To: Balazs Hansel
Cc: Jessica Cuskelly
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Please be advised that the fieldwork might be pushed back by a week given that we still waiting on response for the methodology.

Please do not hesitate to contact us should you have any questions or discussing the project further.

Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant
Sydney



Excellence in your environment
M 0488 224 300 T 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E bhansel@niche-eh.com W niche-eh.com



From: Balazs Hansel
Sent: Monday, 20 August 2018 9:49 PM
To: Balazs Hansel
Cc: Jessica Cuskelly
Subject: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Samuel Ward

From: lilly carroll <didgengunawalclan@yahoo.com.au>
Sent: Friday, 14 September 2018 2:17 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Hi Balasz,

So far the nominated rep for DNC would be Eddie Funaki- 0447994800, thanks heaps Balasz,

Kind regards
Paul Boyd & Lilly Carroll
Directors DNC

Sent from Yahoo Mail for iPhone

On Friday, September 14, 2018, 11:18 am, Balazs Hansel wrote:

Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Please be advised that the fieldwork might be pushed back by a week given that we still waiting on response for the methodology.

Please do not hesitate to contact us should you have any questions or discussing the project further.

Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant

Sydney

The logo for 'niche Environment and Heritage' features the word 'niche' in a bold, lowercase sans-serif font. A green leaf-like graphic is positioned above the 'e'. Below 'niche' are the words 'Environment and Heritage' in a smaller, all-caps sans-serif font.

Excellence in your environment
M [0488 224 300](tel:0488224300) T [02 9630 5658](tel:0296305658)

A PO Box 2443 North Parramatta NSW 1750

Samuel Ward

From: lilly carroll <didgengunawalclan@yahoo.com.au>
Sent: Friday, 14 September 2018 1:59 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

Hi Balasz,

Keep us posted for any further updates

Kind regards
Paul Boyd & Lilly Carroll
Directors DNC

Sent from Yahoo Mail for iPhone

On Friday, September 14, 2018, 11:18 am, Balazs Hansel wrote:

Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

- Current insurances (certificate of currency and workers compensation insurance).
- Name and contact details of the nominated individual

Please be advised that the fieldwork might be pushed back by a week given that we still waiting on response for the methodology.

Please do not hesitate to contact us should you have any questions or discussing the project further.

Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant

Sydney

The logo for 'niche Environment and Heritage' features the word 'niche' in a bold, lowercase sans-serif font. A small green leaf icon is positioned above the 'e'. Below 'niche' are the words 'Environment and Heritage' in a smaller, lighter sans-serif font.

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A PO Box 2443 North Parramatta NSW 1750

Samuel Ward

From: lilly carroll <didgengunawalclan@yahoo.com.au>
Sent: Friday, 14 September 2018 2:11 PM
To: Balazs Hansel
Subject: Re: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 2 and 3 Methodology and project information

DNC agrees to the proposed methodology @ Nelson Bay Rd, Anna Bay

Sent from Yahoo Mail for iPhone

On Friday, September 14, 2018, 11:18 am, Balazs Hansel wrote:

Dear All,

This is a reminder email that the period for commenting on the methodology for the abovementioned project will be closing at 5pm, next Tuesday on 18 September 2018.

Please provide your feedback before that date. Please also provide the following documentations should you want to be considered for the upcoming field inspection:

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Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant

Sydney



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E bhansel@niche-eh.com W niche-eh.com



Samuel Ward

From: Anthony Anderson <murroomainc1@gmail.com>
Sent: Thursday, 10 January 2019 1:16 PM
To: Balazs Hansel
Subject: Re: our ref. 4017 - 4226 Nelson Bay Rd, Anna Bay - ACHA Stage 3 requesting information

Hi Balazs,

After reading your email I was unsure if there was a timeframe to respond or if we should just wait to respond to the draft ACHAR- Im happy to do both:

Your recommendations as outlined do reflect the project area however I'd like to note a few things:

- the site which is identified on the site card (AHIMS ID#38-5-0320) and within the project area has already been destroyed by the property that has been recently built and the owner/proponent needs to be aware of this. As a group we have taken this further and are in current discussions with OEH and Port Stephens Council regarding BA approval on top of our registered site.
- GPR is a good idea within the dune system but i'm unsure how much this would be able to penetrate to detect sites. I'd like to know more information on scope of works for the shed/operator's house as there may be other sites as visibility was very low in this area (possible testing there?).
- In keeping with all other local sand quarries we have Heritage Management Plans in place to ensure any future detection of cultural material and to monitor ongoing sand mining for protection of all cultural material. As you are aware the dunes are always moving and this area is extremely significant to our local people. An example within these plans are cultural awareness training for employees and monthly sieve/screen monitoring. I believe this should be implemented for this quarry also as all others are following our heritage guidelines within the area.

Thanks
Bec Young
Murrooma Operations Manager

On Thu, Dec 6, 2018 at 8:21 PM Balazs Hansel <bhansel@niche-eh.com> wrote:

Dear All,

Thank you again for the contribution to this project so far and also for those who have already provided some feedback for the project.

WE are in the process of drafting the ACHAR/AR and will meet with the client and possibly OEH in relation to our recommendations for the project.

I thought it would be the best to have a discussion with all the RAPs in relation to our assessment of the proposed sand quarry and associated access track before we finalise the draft and send it out for you to comment on. It is our understanding that this would serve the best of the consultation guidelines, the mutual respect to exchange information and also to make sure that everyone has the opportunity to have their say.

Please find a summary of what we have found out during the project so far below:

B3.3 Cultural heritage survey

Morgan Disspain

From: Balazs Hansel
Sent: Monday, 8 October 2018 7:18 AM
To: Balazs Hansel
Subject: RE: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 3 Site inspection/survey
Attachments: 4017_Figure_2_Site_AHA.pdf; 4017_Figure_1_Location_AHA.pdf

Dear All,

Further to my previous email, please find a couple of maps for the Subject Area attached. The address is 4226 Nelson Bay Road, Anna Bay.

Kind Regards,

BALAZS HANSEL MA(Arch) MA(Hist)
Senior Heritage Consultant
Sydney



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A PO Box 2443 North Parramatta NSW 1750
E bhansel@niche-eh.com W niche-eh.com



From: Balazs Hansel
Sent: Sunday, 7 October 2018 9:22 AM
To: Balazs Hansel
Subject: 4017 - Re: 4226 Nelson Bay Road, Anna Bay NSW - Stage 3 Site inspection/survey

Dear All,

Thank you for your continuous contribution for the consultation process for the above mentioned project. Please note that the Proponent made a decision on including in the field inspection all of those Registered Aboriginal Parties who provided all required documents.

Please find the details of the site survey below:

- Survey take place at 9:00am on the 11 October, next Thursday. Please be on site at least 10 minutes to 9 to allow us to run through all safety procedures and a short toolbox.
- Please wear appropriate clothing and also bring wet weather gear as well.
- The field survey is scheduled to last approximately 3 to 4 hours.
- The Proponent is offering to pay \$330.00/half day, plus disbursements.

Should you agree with the above listed details and decide to take part in the field survey, please respond as soon as possible and include the name and contact details of the nominated site officer attending the survey.

Kind Regards

BALAZS HANSEL MA(Arch) MA(Hist)

Senior Heritage Consultant

Sydney



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E bhansel@niche-eh.com **W** niche-eh.com



B3.4 Notification of archaeological test excavation

From: [Morgan Disspain](#)
To: ["Andrew@worimi.org.au"](mailto:Andrew@worimi.org.au)
Subject: Anna Bay test excavation (4017)
Date: Wednesday, 3 July 2019 11:21:07 AM

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

Please note: These dates are tentative relying on advice from OEH and may change.

Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site.

Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing.

Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,
Morgan Disspain

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

M 0488 774 566 **T** 02 9630 5658
A 25 Sherwood Drive Port Macquarie NSW 2444
P PO Box 1156 Port Macquarie NSW 2444
E mdisspain@niche-eh.com **W** niche-eh.com

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From: [Morgan Disspain](#)
To: ["karuahindigenous@outlook.com"](mailto:karuahindigenous@outlook.com)
Subject: Anna Bay Test excavations 4017
Date: Wednesday, 3 July 2019 11:20:33 AM

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

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Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,
Morgan Disspain

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

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A 25 Sherwood Drive Port Macquarie NSW 2444
P PO Box 1156 Port Macquarie NSW 2444
E mdisspain@niche-eh.com **W** niche-eh.com

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From: [Morgan Disspain](#)
To: ["murroomainc1@gmail.com"](mailto:murroomainc1@gmail.com)
Subject: Anna Bay test excavation (4017)
Date: Wednesday, 3 July 2019 11:19:06 AM

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

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Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,
Morgan Disspain

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

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P PO Box 1156 Port Macquarie NSW 2444
E mdisspain@niche-eh.com **W** niche-eh.com

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From: [Morgan Disspain](#)
To: ["lennie.anderson011@bigpond.com"](mailto:lennie.anderson011@bigpond.com)
Subject: Anna Bay Test excavation (4017)
Date: Wednesday, 3 July 2019 11:18:04 AM

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

Please note: These dates are tentative relying on advice from OEH and may change.

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Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,
Morgan Disspain

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Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

M 0488 774 566 **T** 02 9630 5658
A 25 Sherwood Drive Port Macquarie NSW 2444
P PO Box 1156 Port Macquarie NSW 2444
E mdisspain@niche-eh.com **W** niche-eh.com

EXCELLENCE IN YOUR ENVIRONMENT



From: [Morgan Disspain](#)
To: ["worimitoc@hotmail.com"](mailto:worimitoc@hotmail.com)
Subject: Anna Bay Test Excavation (4017)
Date: Wednesday, 3 July 2019 11:17:35 AM

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

Please note: These dates are tentative relying on advice from OEH and may change.

Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site.

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Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,
Morgan Disspain

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Wade Goldwyer

From: /O=SECURE/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9D18E18C92F546608406D6519689AE4A-MDISSPAIN_NICHE
Sent: Monday, 8 July 2019 11:17 AM
To: lennie.anderson011 lennie.anderson011
Subject: RE: Anna Bay Test excavation (4017)

Hello Lennie,

Thank you for your email and insurances.

Please be advised that the client has agreed to pay [REDACTED]

Kind regards,
Morgan

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

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E mdisspain@niche-eh.com W niche-eh.com

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From: lennie.anderson011 lennie.anderson011 [mailto:lennie.anderson011@bigpond.com]
Sent: Thursday, 4 July 2019 2:58 PM
To: Morgan Disspain
Subject: Re: Anna Bay Test excavation (4017)

Hi Morgan,

Information as requested, you will note current rates of pay which has been in the system for well over six (6) Months.

Thanking You

Lennie Anderson OAM
Nur-Run-Gee Pty Ltd
(Director)
Mob;0431 334 365

----- Original Message -----

From: "Morgan Disspain"

To: "'lennie.anderson011@bigpond.com'"

Sent: Wednesday, 3 Jul, 2019 At 11:18 AM

Subject: Anna Bay Test excavation (4017)

Dear Sir/Madam,

Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm.

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Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance.

The client has agreed to pay [REDACTED]. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the

change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication.

Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

Please send me the name and contact details of your nominated site officer as soon as you are able.

Looking forward to having you onsite.

Kind regards,

Morgan Disspain

DR MORGAN DISSPAIN BArch. (Hons), PhD

Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant

Coffs Harbour NSW

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E mdisspain@niche-eh.com **W** niche-eh.com

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B3.5 Archaeological test excavation

Wade Goldwyer

From: /O=SECURE/OU=EXCHANGE ADMINISTRATIVE GROUP (FYDIBOHF23SPDLT)/CN=RECIPIENTS/CN=9D18E18C92F546608406D6519689AE4A-MDISSPAIN_NICHE
Sent: Monday, 29 July 2019 9:27 AM
To: Julie Wells
Subject: Worimi TOIC invoice (4017)
Attachments: Invoice 1143 .pdf

Good morning Julie,

Please find the attached invoice from Worimi Traditional Owners Indigenous Corporation for last week's test excavation.

Kind regards,
Morgan

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

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A 25 Sherwood Drive Port Macquarie NSW 2444
P PO Box 1156 Port Macquarie NSW 2444
E mdisspain@niche-eh.com W niche-eh.com

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From: Worimi TOC [<mailto:worimitoc@hotmail.com>]
Sent: Friday, 26 July 2019 1:21 PM
To: Morgan Disspain
Subject: Re: 4017 Anna Bay excavations next week.

Hi Morgan,

Please see attached invoice for payment.
Could you please forward to accounts for payment.

Regards,
Candy

Candy Towers

Worimi Custodian
Worimi Traditional Owners Indigenous Corporation
Ph: 0412 475 362
e: worimitoc@hotmail.com



Guudji Yiigu, I am a Worimi and Yorta Yorta woman from Newcastle NSW, I acknowledge and pay my respects to the traditional owners and custodians of the land on which I live and work, to their continuing connection to land, water, culture and community and pay my respects to the Elders past, present and to our future generations.

From: Morgan Disspain <mdisspain@niche-eh.com>
Sent: Wednesday, 17 July 2019 12:05 PM
To: Wade Goldwyer <wgoldwyer@niche-eh.com>
Cc: 'julie@tatland.com.au' <julie@tatland.com.au>
Subject: 4017 Anna Bay excavations next week.

Dear Sir/Madam,

Please be advised that the test excavation at Anna Bay (4226 Nelson Bay Road) is confirmed for Tuesday 23rd July through to Thursday 25th of July. Start of work will be on site at 8am and will finish at 4pm. Please meet at the front of the property.

Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing.

If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule.

Could you please send through the name and phone number of the representative that will be assisting with the excavation.

If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

If you haven't already sent me the sub consultancy agreement, can you please do so by the end of this week.

See you all next week!

Kind regards,
Morgan

DR MORGAN DISSPAIN BArch. (Hons), PhD
Associate Member, Australian Association of Consulting Archaeologists Inc.
Senior Heritage Consultant
Coffs Harbour NSW

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B4 Stage 4 – Review of draft Aboriginal cultural heritage assessment report

20 August 2019

Dear Sir/Madam,

Re: Anna Bay Sand Quarry – Draft Aboriginal Cultural Heritage Assessment report (Niche ref #4017)

Thank you for your contributions to the Anna Bay Sand Quarry project to date. As a Registered Aboriginal Party, we are writing to ask for your feedback on the Draft Aboriginal Cultural Heritage Assessment for the project in accordance with Stage 4 of the NSW Office of Environment and Heritage (OEH) *Aboriginal Cultural Heritage consultation requirements for proponents 2010* guidelines.

The Aboriginal Cultural Heritage Assessment report includes an archaeological report (Appendix 1).

Please provide any written comments or submissions on the draft reports **within 28 days, or by 17 September 2019**.

In your review, please provide relevant information about:

- Management and mitigation options for Aboriginal object(s) or place(s) that you consider appropriate.
- The cultural values of any identified Aboriginal objects or places within the project
- Whether there are any additional Aboriginal objects of cultural value to Aboriginal people in the area of the proposed project.
- Whether there are any additional places of cultural value to Aboriginal people in the area of the proposed project (whether they are Aboriginal places declared under s 84 of the National Parks and Wildlife Act 1974 or not). This will include places of social, spiritual and cultural value, historic places with cultural significance and potential places/areas of historic, social, spiritual and/or cultural significance.
- Whether there are any intellectual property or information restrictions on the information you are providing and how that information should be managed.
- Any additional information that you see as relevant.

Please send your feedback to:

Tattersall Lander
c/ Dr Morgan Disspain
Niche Environment and Heritage
PO Box 2443
North Parramatta NSW 1750
Telephone: 0488 774 566
Email: mdisspain@niche-eh.com

Yours sincerely,



Dr Morgan Disspain
Senior Archaeologist & Heritage Consultant
Niche Environment and Heritage

B4.1 Responses to draft ACHA report for Aboriginal Heritage Impact Permit Application

From: [lilly_carroll](#)
To: [Morgan Disspain](#)
Subject: Re: 4017 Anna Bay ACHA and test excavation methodology
Date: Saturday, 9 March 2019 8:22:52 PM
Attachments: [image001.png](#)

Hi Morgan,

DNC agrees with the methodology for Anna Bay test excavation,

Kind regards
Paul Boyd & Lilly Carroll
Directors DNC

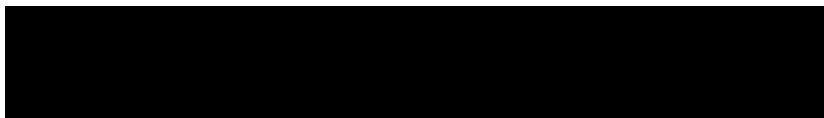
[Sent from Yahoo Mail for iPhone](#)

On Friday, March 8, 2019, 3:37 pm, Morgan Disspain <mdisspain@niche-eh.com> wrote:

Dear Paul,

Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP [1191380](#): 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system.

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents (2010), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment.



If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.

Kind regards,

Morgan Disspain

From: Morgan Disspain
Sent: Tuesday, 5 February 2019 3:32 PM
To: 'didgengunawalclan@yahoo.com.au'
Subject: 4017 Anna Bay ACHA

Dear Paul,

Please be advised that the Anna Bay Sand Quarry ACHAR will be proceeding over the next few months.

As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location.

Kind regards,

Morgan

Dr Morgan Disspain
Senior Heritage Consultant

Coffs Harbour



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M [0488 774 566](tel:0488774566) **T** [02 9630 5658](tel:0296305658)

A PO Box 2443 North Parramatta NSW 1750
E mdisspain@niche-eh.com **W** niche-eh.com



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From: [WIDESCOPE.](#)
To: [Morgan Disspain](#)
Subject: RE: 4017 Anna Bay ACHA and test excavation methodology
Date: Friday, 15 March 2019 3:34:33 PM
Attachments: [image001.png](#)

Hi,

I have reviewed and support the Anna Bay ACHA and test excavation methodology

Regards
Steven Hickey

From: Morgan Disspain <mdisspain@niche-eh.com>
Sent: Friday, March 8, 2019 3:38:14 PM
To: 'Widescope.group@live.com'
Subject: RE: 4017 Anna Bay ACHA and test excavation methodology

Dear Steven,

Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system.

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents (2010), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment.

[REDACTED]

If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.

Kind regards,
Morgan Disspain

From: Morgan Disspain
Sent: Tuesday, 5 February 2019 3:35 PM
To: 'Widescope.group@live.com'
Subject: 4017 Anna Bay ACHA

Dear Steven,

Please be advised that the Anna Bay Sand Quarry ACHA will be proceeding over the next few months.

As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location.

Kind regards,
Morgan

Dr Morgan Disspain
Senior Heritage Consultant
Coffs Harbour



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M 0488 774 566 **T** 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E mdisspain@niche-eh.com **W** niche-eh.com

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From: [Anthony Anderson](#)
To: [Morgan Disspain](#)
Subject: Re: 4017 Anna Bay ACHA and test excavation methodology
Date: Friday, 29 March 2019 10:26:10 AM
Attachments: [image001.png](#)
[Niche- draft assessment methodology Anna Bay.doc](#)

Hi Morgan,

Please find attached Murrooma's response to the ACHA and Methodology for Proposed Sand Quarry- Anna Bay.
Any questions
please call
Thanks

Bec Young
Operations Manager
0421078695

On Fri, Mar 8, 2019 at 3:30 PM Morgan Disspain <mdisspain@niche-eh.com> wrote:

Dear Bec,

-

[Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment \(ACHA\) to inform an Environmental Impact Statement \(EIS\) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system.](#)

-

[In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents \(2010\), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment.](#)

-

[REDACTED]

-

-

[If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.](#)

-

[Kind regards,](#)

[Morgan Disspain](#)

-

-

From: Morgan Disspain

Sent: Tuesday, 5 February 2019 3:34 PM

To: 'murroomainc1@gmail.com'

Subject: 4017 Anna Bay ACHA

-

Dear Bec,

-

Please be advised that the Anna Bay Sand Quarry ACHA will be proceeding over the next few months.

As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location.

-

Kind regards,

Morgan

-

-

Dr Morgan Disspain

Senior Heritage Consultant

[Coffs Harbour](#)



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-

M 0488 774 566 **T** 02 9630 5658

A PO Box 2443 North Parramatta NSW 1750

E mdisspain@niche-eh.com **W** niche-eh.com

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[Anthony Anderson](#)
[CEO Mur-roo-ma Incorporated](#)
[Justice of The Peace](#)

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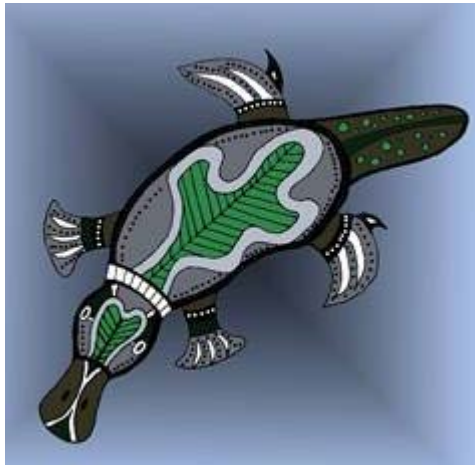
From: [Ryan Johnson](#)
To: [Morgan Disspain](#)
Subject: RE: 4017 Anna Bay ACHA and test excavation methodology
Date: Wednesday, 3 April 2019 4:17:13 PM
Attachments: [image009.png](#)
[image010.png](#)
[image012.png](#)
[image014.png](#)

Hi Morgan,

I have read the ACHA and test excavation methodology for the above project, I endorse the recommendations made by Niche, please feel free to contact me if you require further details.

Kind regards

Ryan Johnson | **Murra Bidgee Mullangari**
0475565517



Aboriginal Corporation Cultural Heritage

A: PO Box 246, Seven Hills, NSW, 2147
E: murrabidgeemullangari@yahoo.com.au
ICN: 8112

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From: Morgan Disspain [mailto:mdisspain@niche-eh.com]
Sent: Friday, 8 March 2019 3:37 PM
To: 'murrabidgeemullangari@yahoo.com.au' <murrabidgeemullangari@yahoo.com.au>
Subject: RE: 4017 Anna Bay ACHA and test excavation methodology

Dear Sir/Madam,

Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system.

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents (2010), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment.

[REDACTED]

If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.

Kind regards,
Morgan Disspain

From: Morgan Disspain
Sent: Tuesday, 5 February 2019 3:31 PM
To: 'murrabidgeemullangari@yahoo.com.au'
Subject: 4017 Anna Bay ACHA

To whom it may concern,

Please be advised that the Anna Bay Sand Quarry ACHAR will be proceeding over the next few months.

As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location.

Kind regards,
Morgan

Dr Morgan Disspain
Senior Heritage Consultant
Coffs Harbour



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M 0488 774 566 T 02 9630 5658

A PO Box 2443 North Parramatta NSW 1750
E mdisspain@niche-eh.com **W** niche-eh.com

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From: [Deidre Perkins](#)
To: [Morgan Disspain](#)
Subject: Re: 4017 Anna Bay sand quarry and test excavation methodology
Date: Tuesday, 19 March 2019 8:40:50 AM
Attachments: [image001.png](#)

Goodmorning Morgan,
No comment it all seems good and I know if any issues came up on site it would be look after.
Sincerely Deidre

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From: Morgan Disspain <mdisspain@niche-eh.com>
Sent: Friday, March 8, 2019 3:36:26 PM
To: 'dedemaree3@hotmail.com'
Subject: RE: 4017 Anna Bay sand quarry and test excavation methodology

Dear Sir/Madam,

Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system.

In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents (2010), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment.



If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019.

Kind regards,
Morgan Disspain

From: Morgan Disspain
Sent: Tuesday, 5 February 2019 3:29 PM
To: 'dedemaree3@hotmail.com'
Subject: 4017 Anna Bay sand quarry

Dear Deidre

Please be advised that the Anna Bay Sand Quarry ACHAR will be proceeding over the next few months.

As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location.

Kind regards,
Morgan

Dr Morgan Disspain
Senior Heritage Consultant
Coffs Harbour



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M 0488 774 566 T 02 9630 5658
A PO Box 2443 North Parramatta NSW 1750
E mdisspain@niche-eh.com W niche-eh.com



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MUR - ROO - MA



INCORPORATED

9 Vardon Road
Fern Bay NSW 2295
Ph: 02 49281910
M: 0402827482
Murroomainc1@gmail.com
ABN: 97 807 719 484

29th of March 2019

Niche Environment and Heritage
Att: Morgan Disspain

Re: Draft Assessment Methodology – Aboriginal Cultural Heritage and
Archaeological Assessment for proposed sand quarry at Lot 591 DP 1191380: 4226
Nelson Bay Road, Anna Bay

To Morgan,

Murrooma Incorporated has read and fully understands the draft Aboriginal Cultural Heritage and Archaeological Assessment from Niche, commissioned by Tattersall Lander for proposed project at Anna Bay.

We agree with all aspects of this report and have viewed the draft methodology strategies and proposed test excavation methodology as outlined. Murrooma has previously discussed the importance of this area and significance to our people. We appreciate the use of Murrooma's idea to have a potential cultural heritage management plan in line with all other sand quarries locally and understand this will be discussed further into the assessment framework.

Murrooma agrees with the test excavation methodology and agrees with the difficulty of testing the unstable land form/dune system but agree it definitely needs to be tested/sampled, due to the movement of the sand dunes and constantly changing conditions. Eg there may be a visual site there one day and then with movement of the dune you can return to same area and not be able to see any sites.

The recommendations and methodologies within this draft report meet our requirements as Traditional knowledge holders of this area and maintain the protection and best options for our local Aboriginal sites.

Please contact if you have any questions,

Thankyou

Bec Young- Murrooma -Operations Manager/Sites Officer
Anthony Anderson - Murrooma- CEO.

B4.2 Responses to draft ACHA report and Archaeological Report

Morgan Disspain

From: Wade Goldwyer
Sent: Wednesday, 21 August 2019 10:54 AM
To: Deidre Perkins
Cc: Morgan Disspain
Subject: RE: 4017 Anna Bay- ACHAR and AR Review

Good morning Deidre,

Thank you for your feedback.
Hope that you have a good week.

Kind regards,
Wade

From: Deidre Perkins <dedemaree3@hotmail.com>
Sent: Tuesday, 20 August 2019 4:38 PM
To: Wade Goldwyer <wgoldwyer@niche-eh.com>
Subject: Re: 4017 Anna Bay- ACHAR and AR Review

Hello Wade,
I have read over the draft and it seems fine to me .
Thank you
Deidre 😊

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From: Wade Goldwyer <wgoldwyer@niche-eh.com>
Sent: Tuesday, August 20, 2019 1:30:23 PM
Cc: Morgan Disspain <mdisspain@niche-eh.com>
Subject: 4017 Anna Bay- ACHAR and AR Review

Dear Sir/Madam,

Thank you for your contributions to the Anna Bay Sand Quarry project to date. As a Registered Aboriginal Party, we are writing to ask for your feedback on the attached Draft Aboriginal Cultural Heritage Assessment for the project in accordance with Stage 4 of the NSW Office of Environment and Heritage (OEH) *Aboriginal Cultural Heritage consultation requirements for proponents 2010* guidelines.

The Aboriginal Cultural Heritage Assessment report includes an archaeological report. Please see link attached:
<https://niche-eh.sharefile.com/d-s8617f40a3294ac38>

Please provide any written comments or submissions on the draft reports within 28 days, or by 17 September 2019.

Kind regards,
WADE GOLDWYER BA (Hons)
Cultural Heritage Technical Assistant
Sydney Head Office

M 0458 001 164 T 02 9630 5658
A L4/460 Church Street Parramatta NSW 2150
P PO Box 2443 North Parramatta NSW 1750
E wgoldwyer@niche-eh.com W niche-eh.com

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Morgan Disspain

From: Wade Goldwyer
Sent: Wednesday, 28 August 2019 8:21 AM
To: David Feeney
Cc: Morgan Disspain
Subject: RE: 4017 Anna Bay- ACHAR and AR Review

Hi Dave,

Thank you very much for your response regarding the Anna Bay ACHAR and AR review.
We will be in touch with regards to further works.

Kind regards,
Wade

From: David Feeney <karuahindigenous@outlook.com>
Sent: Tuesday, 27 August 2019 1:57 PM
To: Wade Goldwyer <wgoldwyer@niche-eh.com>
Subject: Re: 4017 Anna Bay- ACHAR and AR Review

Date: 27th August 2019

WADE GOLDWYER BA (Hons)
Cultural Heritage Technical Assistant

Sydney Head Office

L4/460 Church Street Parramatta NSW 2150

PO Box 2443 North Parramatta NSW 1750

Hi Wade;

Firstly; thanks for the Draft report, I have read the report and understand all parts of the report also the including the archaeological survey report in which I found to be OK.

I also agree to all recommendation of the report and happy to continue with any works around the Anna Bay Sand Quarry project Lot 4017_4226 Nelson Bay Road, Anna Bay NSW, and give and information as required around Cultural & Heritage with this project.

Thank you

Dave Feeney

Dave Feeney

Snr Aboriginal Cultural Officer

Karuah Indigenous Corporation

From: Wade Goldwyer <wgoldwyer@niche-eh.com>

Sent: Tuesday, August 20, 2019 5:30 AM

Cc: Morgan Disspain <mdisspain@niche-eh.com>

Subject: 4017 Anna Bay- ACHAR and AR Review

Dear Sir/Madam,

Thank you for your contributions to the Anna Bay Sand Quarry project to date. As a Registered Aboriginal Party, we are writing to ask for your feedback on the attached Draft Aboriginal Cultural Heritage Assessment for the project in accordance with Stage 4 of the NSW Office of Environment and Heritage (OEH) *Aboriginal Cultural Heritage consultation requirements for proponents 2010* guidelines.

The Aboriginal Cultural Heritage Assessment report includes an archaeological report. Please see link attached:

[REDACTED]

Please provide any written comments or submissions on the draft reports within 28 days, or by 17 September 2019.

Kind regards,

WADE GOLDWYER BA (Hons)

Cultural Heritage Technical Assistant

Sydney Head Office

M 0458 001 164 T 02 9630 5658

A L4/460 Church Street Parramatta NSW 2150

P PO Box 2443 North Parramatta NSW 1750

E wgoldwyer@niche-eh.com W niche-eh.com

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9 Vardon Road
Fern Bay NSW 2295
Ph: 0421078695
M: 0402827482
Murroomainc1@gmail.com
ABN: 97 807 719 484

Friday 6th of September 2019

Niche

Att: Morgan Disspain

Re: Draft Assessment Methodology – Aboriginal Cultural Heritage and
Archaeological Assessment for Proposed Anna Bay Sand Quarry- Anna Bay.

To Morgan,

Murrooma Incorporated has read and fully understands the draft Aboriginal Cultural
Heritage and Archaeological Assessment report for Anna Bay Sand Quarry.

As per our phone discussion, no sand will be quarried from any part of the remnant
dune and only drift sand will be utilised for proposed works- for the entirety of the
sand mining contract .

We agree with all aspects of this report including the results of the test excavation,
proposed mitigation and recommendations and this meets our requirements as
Traditional Knowledge Holders of the Worimi area and maintains the protection and
best options for our local Aboriginal sites.

Please contact if you have any questions,

Thankyou

Bec Young- Murrooma -Operations Manager/Sites Officer
Anthony Anderson - Murrooma- CEO.

B5 Consultation Log

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
15/03/2018	Charmaine Murfet	Corporate & Community Lachlan Shire Council	Email	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	07:00am	CL	No further response required
15/03/2018	Samantha Wynn	Senior Team Leader, Planning Office of Environment and Heritage Planning and Aboriginal Heritage Section PO Box 211 Dubbo NSW 2830	Letter registration #60436363457090	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	n/a	CL	No further response required
15/03/2018	Jodie Rikiti	The Registrar Office of the Registrar, Aboriginal Land Rights Act 1983 (NSW) PO Box 5068 Parramatta NSW 2124	Email	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	07:00am	CL	No further response required
15/03/2018	George Tonna	NTS Corp Limited PO Box 2105 Strawberry Hills NSW 2012	Email and Letter registration #60436363558094	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	n/a	CL	No further response required

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
15/03/2018	Graham Kelly	Senior Strategic Land Services Officer (Aboriginal Communities) Local Land Services - Central West PO Box 108 Coonabarabran NSW 2357	Letter registration #60436363561094	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	07:00am	CL	No further response required
15/03/2018	Mr Dave Carter Snr	CEO Condobolin Local Aboriginal Land Council	Email	Clare Leever	Niche Environment and Heritage	Stage 1 Notification - Agency Letter	07:00am	CL	No further response required
15/03/2018	To whom it may concern	National Native Title Tribunal	Web form	Clare Leever	Niche Environment and Heritage	Stage 1 registry search	07:00am	CL	No further response required
24/04/2018	Mr Stephen Cox	Hunter OEH	Email with letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent	16:00	CM	
24/04/2018	Mr Peter Shultz	NTS Corp Limited PO Box 2105 Strawberry Hills NSW 2012	Email with letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent	16:00	CM	
24/04/2018		NNTT	Email request form	Caitlin Marsh	Niche Environment and Heritage	Search of Native Title	16:00	CM	
24/04/2018		Office of the Registrar Aboriginal Land Rights Act 1983 (NSW)	Email with letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent	16:00	CM	
24/04/2018	Toby Whaleboat	Hunter Local Land Services	Email with letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent	4:00 PM	CM	
24/04/2018		Port Stephens Local Council	letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent			

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
24/04/2018		Worimi Local Aboriginal Land Council	letter	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Agency Letter sent			
25/04/2018	Local Community	News of the Area	Newspaper Advertisement	Caitlin Marsh	Niche Environment and Heritage	Stage 1 Newspaper Ad	n/a	CM	no follow up required
26/04/2018	Caitlin Marsh	Niche Environment and Heritage	Email		National Native Title Tribunal	Stage 1 Agency response	0:00	CM	Subject Area freehold land; no follow up required
01/05/2018	Caitlin Marsh	Niche Environment and Heritage	email	Jodie Rikiti	Office of the Registrar Aboriginal Land Rights Act 1983 (NSW)	Stage 1 Agency letter response	14:00	CM	Noted that the Subject Area may be within the Worimi Conservation Lands area.
01/05/2018	Jess Cuskelly	Niche Environment and Heritage	email	Jamie Merrick	Worimi Local Aboriginal Land Council	Stage 1 Agency response	11:00	CM	LALC notifying of other groups: Anthony Anderson; Murroomainc1@gmail.com; Lennie Anderson
01/05/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Leonard James Anderson	Nur-Run-Gee Pty Ltd	Stage 1 Agency response	18:00	CM	Registering interest in project, notifying of Worimi LALC & Murrooma Inc. and Maingal
02/05/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Brett Gardiner	Port Stephens LC	Stage 1 Agency response	10:48	CM	List more interest groups for consultation: 355c Committee being the Birubi Point Cultural Heritage Advisory Panel; Carol Ridgeway-Bissett: Traditional Owner; Graeme Russell is the Joint Management Coordinator of the Worimi Conservation Lands Board of Management. File names in the Consultation Register
09/05/2018	Balazs Hansel	Niche Environment and Heritage	Email	Steven Cox	OEH	Stage 1 response	19:00	BH	Noted that the right list came through and filed.
30/05/2018	All potential RAPs	All potential RAPs	Email/Express post	Balazs Hansel	Niche Environment and Heritage	Stage 1 Letter	15:00	BH	Stage 1 letter for all potential RAPs have been sent out via email and two express post envelopes (Crimson Rosie and Carol Ridgeway-Bassett)
30/05/2018	Balazs Hansel	Niche Environment and Heritage	Email	Lilly Carroll	Didge Ngunawal	Registering on project	13:20	BH	Acknowledged, filed and responded.
30/05/2018	Balazs Hansel	Niche Environment and Heritage	Email	Deidre Perkins	Divine Diggers	Registering on project	14:15	BH	Acknowledged, filed and responded.
04/06/2018	Balazs Hansel	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Registering on project	16:25	BH	Acknowledged, filed and responded.

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
14/06/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Bec Young	Mur-Roo-Ma Inc.	Registering on project	14:16	BH	Acknowledged, filed and responded.
15/06/2018	N/A	N/A	N/A	N/A	N/A	Close of Stage 1	17:00	BH	Stage 1 /Registration closed for the project
22/06/2018	Resent OEH extra	OEH extra RAPS	Email	Jess Cuskelly	Niche Environment and Heritage	Stage 1 Letter	12:25	JC	Stage 1 letter for all potential RAPs have been sent out via email and two express post envelopes (Roger Matthews Consultancy, Wonnarua Elders Council, Carol Ridgeway-Bissett, Steve Talbott)
29/06/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Steven Hickey	Widescope	Registering on project	4:30	JC	Hi Jessica Thank you, please register my interest in the project I am a recognized cultural knowledge holder. I hold knowledge in determining Aboriginal Objects and Place, Regards Steven Hickey
01/07/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Amanda Heard	Steve Talbott	Registering on project	20:01	JC	Hi Jessica I would like to register my expression of interest for the above said project My contact details are: Steven Talbott 73 KIAH road gillieston Heights nsw 2321 0476893944 Kind regards Amanda Heard
20/08/2018	Balazs Hansel	All RAPs	Email	Balazs Hansel	Niche Environment and Heritage	Initiating Stage 2 and 3	9:00	BH	Filing delivery receipts.
21/08/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Stage 2/3 Methodology Response	10:22 PM	JC	Hi Jess, I have read the project information ACHA and methodology for the above project and endorse the recommendations made by Niche. My family and members have a long history in the Anna Bay area, my grandfather resided in Anna Bay for over 10 years, our contact person for this project would be Ryan 0475565517 or Shaun 0400637554. Please see attached insurances. Kind regards

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
07/09/2018	Jess Cuskelly	Niche Environment and Heritage	Email	Anthony Anderson	Mur-Roo-Ma Inc.	Stage 2/3 Methodology Response	12:45pm	BH	N/A
14/09/2018	All RAPs	All RAPs	Email	Balazs Hansel	Niche Environment and Heritage	Follow-up for Stage 2/3 response.	11:00	BH	N/A
14/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Steve Bernasconi	Community Services Section manager-Port Stevens Council on behalf of Birubi Point Cultural Heritage Advisory Panel	Stage 2/3 Methodology Response	11:36	BH	He will pass-on the information to the panel.
14/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Lilly Carroll	Didge Ngunawal	Stage 2/3 Methodology Response	14:07	BH	Filed and responded.
14/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Leonard James Anderson	Nur-Run-Gee Pty Ltd	Stage 2/3 Methodology Response	16:07	BH	Filed and responded. Lennie raised his concerns in relation to handling of information for the project. It will be discussed with the Proponent and RAPs.
14/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Steven Hickey	Widescope	Stage 2/3 Methodology Response	18:17	BH	Filed and responded.
17/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Stage 2/3 Methodology Response	9:45 AM	BH	Filed and responded.
17/09/2018	Balazs Hansel	Niche Environment and Heritage	Email	Jamie merrick	Worimi Local Aboriginal Land Council	Comments on methodology	8:54am	MD	Hi Balazs Worimi agrees with the methodology and would like to register our interest in the project please see the attachments Kind Regards, Jamie Merrick Senior Sites Officer Worimi Local Aboriginal Land Council
18/09/2018	N/A	N/A	N/A	Balazs Hansel	Niche Environment and Heritage	Close of Stage 2 and 3.	17:00		Consolidate all responses of Stage 2 and 3.

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07/10/2018	All RAPs	All RAPs	Email	Balazs Hansel	Niche Environment and Heritage	Details of field survey	9:20am	BH	File and save delivery receipts
07/10/2018	Balazs Hansel	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Confirming field survey attendance	11:30am	BH	filed and responded
07/10/2018	Balazs Hansel	Niche Environment and Heritage	Email	Lilly Carroll	Didge Ngunawal	Confirming field survey attendance	10:12pm	BH	filed and responded
08/10/2018	Balazs Hansel	Niche Environment and Heritage	text message	Ryan Johnson	MBMAC	Confirming field survey attendance	10:50am	BH	filed and responded asking for email confirmation as well
08/10/2018	Balazs Hansel	Niche Environment and Heritage	phone call	Andrew Smith	WLALC	Discussing field survey and site officer availability	1:00pm	BH	He'll sort it out and respond via email
12/10/2018	N/A	N/A	N/A	N/A	N/A	Field inspection at the Subject Area	9:30-12:30pm	BH	Field inspection and survey was carried out successfully with the RAPs. Worimi Traditional Owners have discussed site access with two groups (MBMAC, Didge Ngunawal) before the survey and asked the representatives to exclude themselves from the survey. They agreed and left before the survey.
29/10/2018	All RAPs	All RAPs	Email	Balazs Hansel	Niche Environment and Heritage	Confirming site inspection results and providing invoicing details	8:30am	BH	N/A
06/12/2018	All RAPs	All RAPs	Email	Balazs Hansel	Niche Environment and Heritage	Providing information on proposed meeting with client and OEH in relation to further works that might be needed for the ACHA	8:20pm	BH	N/A

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06/12/2018	Balazs Hansel	Niche Environment and Heritage	Email	Deidre Perkins	Divine Diggers	Expressing satisfaction with the project and supporting the proposed recommendations	8:40pm	BH	Responded, filed.
10/12/2018	Balazs Hansel	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Expressing satisfaction with the project and suggesting monitoring should any excavation happen.	10:50am	BH	Responded, filed. Outlined that the monitoring is not an option but further investigation in the form of test excavation or the use of a GPR investigation might be options.
10/12/2018	N/A	N/A	N/A	N/A	N/A	Meeting with OEH and the Proponent at the Newcastle OEH offices	3:30-4:30 pm	BH	Discussion on the different options to further investigate Aboriginal heritage constraints for the development. It has been decided that amongst other options, an additional test excavation will be needed under an AHIP to further investigate the presence of any Aboriginal objects.
05/02/2019	All RAPS	All RAPS	Email	Morgan Disspain	Niche Environment and Heritage	Informing RAPS of project status	3:37pm	MD	To whom it may concern, Please be advised that the Anna Bay Sand Quarry ACHAR will be proceeding over the next few months. As you are registered to be involved in this project, I wanted to update you on the project status. I will be in touch again soon regarding documents to be reviewed and further cultural heritage works at the location. Kind regards, Morgan
05/02/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lennie Anderson	Nur-Run-Gee Pty Ltd	Informing RAPS of project status	7:36pm	MD	Thank You Morgan, much appreciated. Lennie A

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05/02/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lilly Carroll	Didge Ngunawal Clan	Informing RAPS of project status	4:22pm	MD	Thank you for that Morgan, plz let me know as it progresses
05/02/2019	Morgan Disspain	Niche Environment and Heritage	Email	Andrew Smith	Worimi Local Aboriginal Land Council	Informing RAPS of project status	4:12pm	MD	Hi Morgan, Thank you for the brief. I look forward to hearing back from you shortly. Regards
06/02/2019	Morgan Disspain	Niche Environment and Heritage	Email	Deidre Perkins	Divine Diggers Aboriginal Cultural Consultants	Informing RAPS of project status	12:07pm	MD	Thank you Morgan
14/02/2019	Morgan Disspain	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Informing RAPS of project status	5:43pm	MD	Thanks

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08/03/2019	All RAPs	All RAPs	Email	Morgan Disspain	Niche Environment and Heritage	Sending ACHA and test excavation methodology for comment	3:44pm	MD	Dear Sir/Madam, Niche Environment and Heritage has been commissioned by Tattersall Lander to prepare an Aboriginal Cultural Heritage Assessment (ACHA) to inform an Environmental Impact Statement (EIS) of a proposed sand quarry at Lot 591 DP 1191380: 4226 Nelson Bay Road, Anna Bay. The Subject Area backs onto the Newcastle Bight sand dune system. In accordance with Section 4.2 and Section 4.3 of the Office of Environment and Heritage Aboriginal cultural heritage consultation requirements for proponents (2010), please find enclosed the drop box link to the project information and methodology for the proposed test excavation assessment. If you have any comments, suggestions or queries regarding the methodology, or wish to supply any knowledge regarding the cultural significance of the Subject Area and its immediate surrounds, please contact Niche Environment and Heritage as soon as possible. The statutory time frame for commenting on the methodology closes at 5 pm, 8 April 2019. Kind regards, Morgan Disspain
09/03/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lilly Carroll	Didge Ngunawal Clan	Stage 4 Response	6:21pm	SW	Hi Morgan, DNC agrees with the methodology for Anna Bay test excavation, Kind regards Paul Boyd & Lilly Carroll Directors DNC

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15/03/2019	Morgan Disspain	Niche Environment and Heritage	Email	Steven Hickey	Widescope	Stage 4 Response	15:40	MD	Hi, I have reviewed and support the Anna Bay ACHA and test excavation methodology Regards Steven Hickey
19/03/2019	Morgan Disspain	Niche Environment and Heritage	Email	Deidre Perkins	Divine Diggers Aboriginal Cultural Consultants	Stage 4 Response	9:36am	MD	Good morning Morgan, No comment it all seems good and I know if any issues came up on site it would be look after. Sincerely Deidre

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29/03/2019	Morgan Disspain	Niche Environment and Heritage	Email	Bec Young	Mur-Roo-Ma Inc.	Stage 4 Response	10:51	MD	To Morgan, Murrooma Incorporated has read and fully understands the draft Aboriginal Cultural Heritage and Archaeological Assessment from Niche, commissioned by Tattersall Lander for proposed project at Anna Bay. We agree with all aspects of this report and have viewed the draft methodology strategies and proposed test excavation methodology as outlined. Murrooma has previously discussed the importance of this area and significance to our people. We appreciate the use of Murrooma's idea to have a potential cultural heritage management plan in line with all other sand quarries locally and understand this will be discussed further into the assessment framework. Murrooma agrees with the test excavation methodology and agrees with the difficulty of testing the unstable land form/dune system but agree it definitely needs to be tested/sampled, due to the movement of the sand dunes and constantly changing conditions. E.g. there may be a visual site there one day and then with movement of the dune you can return to same area and not be able to see any sites. The recommendations and methodologies within this draft report meet our requirements as Traditional knowledge holders of this area and maintain the protection and best options for our local Aboriginal sites. Please contact if you have any questions, Thankyou Bec Young- Murrooma -Operations Manager/Sites Officer Anthony Anderson- Murrooma- CEO. +J63
05/04/2019	Morgan Disspain	Niche Environment and Heritage	email	Ryan Johnson	Murra Bidgee Mullangari	Stage 4 Response	4.17 pm	LH	Hi Morgan, I have read the ACHA and test excavation methodology for the above project, I endorse the

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									recommendations made by Niche, please feel free to contact me if you require further details.
03/07/2019	Karuah Indigenous Corporation	Karuah Indigenous Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change. Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the day's fieldwork resulting in lost employment for the group they are representing. Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation

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									insurance and public liability insurance. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication. Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff. Please send me the name and contact details of your nominated site officer as soon as you are able. Looking forward to having you onsite. Kind regards, Morgan Disspain
03/07/2019	Murra Bidgee Mullangari Aboriginal Corporation	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change.

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									Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing. Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication. Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff.

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									Please send me the name and contact details of your nominated site officer as soon as you are able. Looking forward to having you onsite. Kind regards, Morgan Disspain
03/07/2019	Mur-Roo-Ma Incorporated	Mur-Roo-Ma Incorporated	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change. Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the

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									days fieldwork resulting in lost employment for the group they are representing. Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance. Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication. Invoices should be addressed to the Proponent: Hay Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff. Please send me the name and contact details of your nominated site officer as soon as you are able. Looking forward to having you onsite. Kind regards, Morgan Disspain
03/07/2019	Nur-Run-Gee Pty Ltd	Nur-Run-Gee Pty Ltd	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of

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									excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change. Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing. Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance. . Time on site of four hours or less shall be counted as a half day, with all time above four hours deemed a full day of work. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Please ensure that contact details provided to Niche are up to date in order to ensure timely communication. Invoices should be addressed to the Proponent: Hay

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									Enterprises NSW Pty Ltd, and sent through to Niche – they will then be forwarded on to the client. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff. Please send me the name and contact details of your nominated site officer as soon as you are able. Looking forward to having you onsite. Kind regards, Morgan Disspain
03/07/2019	Worimi Traditional Owners Indigenous Corporation	Worimi Traditional Owners Indigenous Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change. Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical

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03/07/2019	Worimi LALC	Worimi LALC	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement		MD	Dear Sir/Madam, Thank you for your continued involvement in the ACHA project for the Anna Bay sand quarry at 4226 Nelson Bay Road, Anna Bay, NSW (Lot 591 DP 1191380). Personnel for field involvement have now been finalised and I am pleased to invite one representative from your organisation to participate in three days of excavations on the 23rd, 24th and 25th July 2019. Start of work will be on site at 8am and will finish at 4pm. Please note: These dates are tentative relying on advice from OEH and may change. Niche considers Health, Safety & Environment (HSE) to be essential in our project work and asks for your cooperation in ensuring a safe work site for yourself and your workmates. As per Niche HSE Policy we will be running a Safe Work Methods Statement (SWMS) and sign-on sheet each day, and ask that any representatives with existing medical conditions please bring any necessary medication with them to site. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing. Considering the amount of time that has passed since the site survey, please send through updated insurance certificates of currency including workers compensation insurance and public liability insurance. Time on site of four hours or less shall be counted as a

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03/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Test Excavation Engagement Response	12:10	MD	Hi Morgan Yes we will be available, thank you for including our corporation. Ryan 0475565517
03/07/2019	Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	12:15pm	MD	Fantastic, Can you please send through Insurance certificates of currency. Thank you very much. Kind regards, Morgan

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03/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Test Excavation Engagement Response	12:30pm	MD	Hi Morgan, Sorry please see attachments. Thanks Ryan Johnson Murra Bidgee Mullangari
03/07/2019	Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	12:30pm	MD	Thank you very much.
03/07/2019	Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	13:48	MD	Dear Ryan, Thank you for your quick reply to my earlier emails. Please be advised that your involvement is no longer required in the test excavation at this stage. My apologies for the inconvenience. Kind regards, Morgan
03/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Test Excavation Engagement Response	14:00	MD	Hi Morgan That was quick what happened
03/07/2019	Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	14:30	MD	Hi Ryan, The client has advised that they only wish to engage the people that were originally involved in the site inspection. Apologies again for the inconvenience, I have recently inherited this project and am still getting up to speed on the consultation process to date. Kind regards, Morgan

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03/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Ryan Johnson	Murra Bidgee Mullangari	Test Excavation Engagement Response	14:40	MD	That's ok no problem
03/07/2019	Ryan Johnson	Murra Bidgee Mullangari Aboriginal Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	14:42	MD	Thank you very much for your understanding. Kind regards, Morgan
03/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Andrew Smith	Worimi Local Aboriginal Land Council	Outside concerns	17:00	MD	Hi Morgan, Thank you for your phone call today; greatly appreciated. Following our discussion; unfortunately due to my Inbox being excessively FULL, my outlook system has automatically archived (and deleted) some folders? As such; I cannot put my hands on the emails forwarded to Hay's Enterprises at this time however; I have attached the annexures that accompanied my correspondence and I'm confident that they (Allan Hay?) would be aware of the issues raised (noting that my emails did not bounce back?). Nonetheless; we (the Worimi LALC and Aboriginal Community) are not impressed with the complacency demonstrated around a adequate onsite land management being conducted by the company. You will note on the survey (as instructed by us and attached for your info); it has listed those items dumped onto our property. In addition to this; we have serious concern about extraction activities in the area and the destabilisation of the common boundary sand dune (in parts). Our desire is that this the area is cleared of debris and other materials and restored (restabilised) ASAP and/or if not, we seek to have our concerns clearly highlighted in the Environmental issues identified as part of the planning assessments 'and' they will be raised with the

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
									Local Council. Not having had ANY response to our raised concerns; only lends itself to a greater sense of distrust towards any ongoing and/or future enterprise developments by the company. Thank you for your time and I look forward to hearing back from you soon. Warm Regards Andrew Smith Chief Executive Officer Worimi Local Aboriginal Land Council
04/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lennie Anderson	Nur-Run-Gee Pty Ltd	Test Excavation Engagement Response	15:00	MD	Hi Morgan, Information as requested, you will note current rates of pay which has been in the system for well over six (6) Months. Thanking You Lennie Anderson OAM Nur-Run-Gee PtyLtd (Director) Mob;0431 334 365
04/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Bec Young	Mur-Roo-Ma Inc.	Test Excavation Engagement Response			Hi Morgan, Murrooma will have a representative on site for the test excavations This will be myself or David Kirk (due to other jobs we will notify who the rep will be once closer) I have attached our up to date insurances as requested Thanks Bec Young 0421078695

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
04/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Jamie Merrick	Worimi Local Aboriginal Land Council	Test Excavation Engagement Response	11:00	MD	Good Morning Morgan See attached Kind Regards, Jamie Merrick Senior Sites Officer
05/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Candy Towers	Worimi Traditional Owners Indigenous Corporation	Test Excavation Engagement Response	13:00	MD	Hi Morgan, I will be sending Aboriginal site officer Luke Knight to attend on behalf of Worimi TOIC on the 23rd/24th and 25th July. Regards, Candy Candy Towers Worimi Custodian Worimi Traditional Owners Indigenous Corporation Ph: 0412 475 362 e: worimitoc@hotmail.com
08/07/2019	Candy Towers	Worimi Traditional Owners Indigenous Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Test Excavation Engagement Response	11:21	MD	Thank you very much Candy. Can you please send through your certificates of currency for insurances as requested? Kind regards, Morgan
08/07/2019	All RAPs	All RAPs	Email	Morgan Disspain	Niche Environment and Heritage	AHIP Notification	16:30	MD	To whom it may concern, Thank you for your ongoing involvement in the Anna Bay sand quarry Aboriginal Cultural Heritage Assessment. Please find the attached AHIP advice and final ACHAR for your records. If you have any questions, please do not hesitate to contact me.

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
									Kind regards, Morgan Disspain
15/07/2019	David Feeney	Karuah Indigenous Corporation	Email	Wade Goldwyer	Niche Environment and Heritage	Test Excavation Engagement	10:13	WG	Good morning David, I hope that you had a good weekend. I was just following up with regards to the Anna Bay excavation next week. Is there anyone from your organisation that will be attending?
15/07/2019	RAPs engaged for test excavation	Worimi Traditional Owners Indigenous Corporation, Worimi LALC, Karuah Indigenous Corporation, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd	Email	Morgan Disspain	Niche Environment and Heritage	Subconsultancy agreement for test excavation	9:30	MD	Good morning all, Please find the attached sub consultancy agreement for the Anna Bay test excavation next week. Can you please fill in the appropriate information and send it back to me before Wednesday this week? If you have your own version that you would prefer to use, please send us a copy to sign. Thank you very much. Kind regards, Morgan
15/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Candy Towers	Worimi Traditional Owners Indigenous Corporation	Subconsultancy agreement for test excavation	6:27 PM	MD	Hi Morgan, Please see attached completed form and Public Liability. Regards, Candy
16/07/2019	Candy Towers	Worimi Traditional Owners Indigenous Corporation	Email	Morgan Disspain	Niche Environment and Heritage	Subconsultancy agreement for test excavation	10:30	md	Good morning Candy, Thank you very much.

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
									Kind regards, Morgan
17/07/2019	RAPs engaged for test excavation	Worimi Traditional Owners Indigenous Corporation, Worimi LALC, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd	Email	Morgan Disspain	Niche Environment and Heritage	Test excavation logistics	12:00	MD	Dear Sir/Madam, Please be advised that the test excavation at Anna Bay (4226 Nelson Bay Road) is confirmed for Tuesday 23rd July through to Thursday 25th of July. Start of work will be on site at 8am and will finish at 4pm. Please meet at the front of the property. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Could you please send through the name and phone number of the representative that will be assisting with the excavation. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff. If you haven't already sent me the sub consultancy agreement, can you please do so by the end of this week. See you all next week!

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
									Kind regards, Morgan
17/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	David Feeney	Karuah Indigenous Corporation	Test excavation logistics	5:35	MD	Hi Morgan; Regarding the My Insurance I will get a copy from Allianz tomorrow and send into you by Lunch time Dave Feeney Snr Cultural Officer Karuah Indigenous Corporation PS: Sorry been late as I have been in Vic rom Sunday and did not look at any emails
17/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lennie Anderson	Nur-Run-Gee Pty Ltd	Test excavation logistics	18:28	MD	Hi Morgan, Our Consultant for Tuesday is Chris Collison, he complies with all requirements and has the Sub Consultancy Agreement with him. Thanking You Lennie Anderson OAM ASM Nur-Run-Gee Pty Ltd (Director)
18/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Test excavation logistics	10:23	MD	Hi Morgan; Please fine attached the Statement of Coverage Insurance Thank you Dave Feeney Snr Cultural Officer Karuah Indigenous Corporation
17/07/2019	RAPs engaged for	Worimi Traditional Owners	Email	Morgan Disspain	Niche Environment and Heritage	Test excavation logistics	12:00	MD	Dear Sir/Madam, Please be advised that the test excavation at Anna Bay

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
	test excavation	Indigenous Corporation, Worimi LALC, Mur-Roo-Ma Inc, Nur-Run-Gee Pty Ltd							(4226 Nelson Bay Road) is confirmed for Tuesday 23rd July through to Thursday 25th of July. Start of work will be on site at 8am and will finish at 4pm. Please meet at the front of the property. Please ensure that the field officer nominated work is of sufficient good health and fitness for the physical work required, that they bring both their own food and water to site, and that they wear full PPE (wide brimmed hat, safety glasses, long sleeved hi-vis shirt, long pants and steel capped safety boots). Please bring wet weather gear. Any representative not wearing appropriate PPE may be unable to be engaged for the days fieldwork resulting in lost employment for the group they are representing. If there are changes in the weather and fieldwork is cancelled, then RAPs will be contacted the day/evening before to notify of the change in schedule. Could you please send through the name and phone number of the representative that will be assisting with the excavation. If you are unable to attend the relevant dates then please let me know as soon as possible so I can organise replacement field staff. If you haven't already sent me the sub consultancy agreement, can you please do so by the end of this week. See you all next week! Kind regards, Morgan

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
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17/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Lennie Anderson	Nur-Run-Gee Pty Ltd	Test excavation logistics	18:28	MD	Hi Morgan, Our Consultant for Tuesday is Chris Collison, he complies with all requirements and has the Sub Consultancy Agreement with him. Thanking You Lennie Anderson OAM ASM Nur-Run-Gee Pty Ltd (Director)
18/07/2019	Morgan Disspain	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	Test excavation logistics	10:23	MD	Hi Morgan; Please find attached the Statement of Coverage Icare Workers Insurance and the My Business Pack Certificate of Currency Allianz Insurance Thank you Dave Feeney Snr Cultural Officer Karuah Indigenous Corporation
20/08/2019	All RAPs	All RAPs	Email	Wade Goldwyer	Niche Environment and Heritage	ACHAR and AR Review	5:30	MD	Dear Sir/Madam, Thank you for your contributions to the Anna Bay Sand Quarry project to date. As a Registered Aboriginal Party, we are writing to ask for your feedback on the

DATE	INDIVIDUAL CONTACTED	ORGANISATION CONTACTED	HOW CONTACTED	CONTACTED BY	ORGANISATION REPRESENTED	NATURE OF CONSULTATION	TIME	Staff Member	Follow up required/detail of correspondence
									attached Draft Aboriginal Cultural Heritage Assessment for the project in accordance with Stage 4 of the NSW Office of Environment and Heritage (OEH) Aboriginal Cultural Heritage consultation requirements for proponents 2010 guidelines. The Aboriginal Cultural Heritage Assessment report includes an archaeological report. Please see link attached: Please provide any written comments or submissions on the draft reports within 28 days, or by 17 September 2019. Kind regards, WADE GOLDWYER BA (Hons)
20/08/2019	Wade Goldwyer	Niche Environment and Heritage	Email	Deidre Perkins	Divine Diggers Aboriginal Cultural Consultants	ACHAR and AR Review	16:38	WG	Hello Wade, I have read over the draft and it seems fine to me. Thank you Deidre
27/08/2019	Wade Goldwyer	Niche Environment and Heritage	Email	Dave Feeney	Karuah Indigenous Corporation	ACHAR and AR Review	13:57	WG	Hi Wade; Firstly; thanks for the Draft report, I have read the report and understand all parts of the report also the including the archaeological survey report in which I found to be OK. I also agree to all recommendation of the report and happy to continue with any works around the Anna Bay Sand Quarry project Lot 4017_4226 Nelson Bay Road, Anna Bay NSW, and give and information as required around Cultural & Heritage with this project. Thank you
30/08/2019	Morgan Disspain	Niche Environment and Heritage	phone call	Bec Young	Mur-Roo-Ma Inc	ACHAR and AR Review	10:15am	MD	Phone conversation with Bec Young about the nature of works within the sand quarry - she wanted to know- will the works target only the drift sand? As per the project description and advice from Hay Enterprises, this is correct, only the drift sand will be removed during the works.

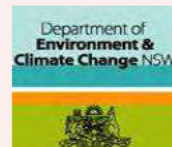
[illegible]

Appendix D: Site Cards for Registered Sites within the Subject Area



Aboriginal Site Recording Form

AHIMS Registrar
PO Box 1967, Hurstville NSW 2220



Office Use Only

Site Number 3 8 5 0 3 2 0

Date received / / Date entered into system / / Date catalogued / /

Entered by (I.D.)

Information Access

☐ Gender/male ☐ Gender/female ☐ Location restriction ☐ General restriction ☐ No access

For Further Information Contact:

☐ Nominated Trustee

Title Surname First Name Initials

Organisation

Address

Phone number Fax

☐ Knowledge Holder

Title Surname First Name Initials

Organisation

Address

Phone number Fax

Aboriginal Heritage Unit or Cultural Heritage Division Contacts

Office Use Only

Client on system

Client on system

Geographic Location

Site Name N B R d 4

Easting 4 1 2 0 4 6 Northing 6 3 7 3 9 4 2 AGD/GDA GDA

Mapsheet N c a s t l e , P o r t S t e p h

Zone 56

Location Method Non-Differential GPS

Other Registration

Primary Recorder

Title Surname First Name Initials

M s M c C a r d l e P e n n y

Organisation M c C a r d l e C u l t u r a l H e r i t a g e

Address P O B o x 1 6 6 A d a m s t o w n N S W 2 2 8

Phone number 0 4 1 2 7 0 2 3 9 6 Fax 5 9 5 2 5 5 0 1

Date recorded 29/05/2013

Client on system

page 2

Open Site

Landform

- ### Slope

degrees

- ☐ Upper slope
- ☐ Plain
- ☐ Ridge
- ☐ Tor
- ☐ Valley flat
- ☐ Levy

- ☐ Stream bank
- ☐ Stream channel
- ☐ Swamp
- ☐ Terrace
- ☐ Terrace flat

☐	Closed forest
☒	Grasslands
☒	Isolated clumps of trees
☐	Open forest
☐	Open woodland
☐	Scrub
☐	Woodland
☐	Cleared
☐	Revegetated
☐	N/A

- ☐ Conservation
- ☐ Established urban
- ☐ Farming-intensive
- ☐ Farming-low intensity
- ☐ Forestry
- ☐ Industrial
- ☐ Mining
- ☒ Pastoral/grazing
- ☐ Recreation
- ☐ Semi-rural
- ☐ Service corridor
- ☐ Transport corridor
- ☐ Urban expansion
- ☐ N/A

Distance to permanent water source

10 metres

Distance to temporary water source

metres

Name of nearest permanent water source

Name of nearest temporary water

Directions for Relocation

A blank 10x10 grid map. The grid is composed of 10 columns and 10 rows of squares. The corners are labeled with compass directions: NW (top-left), NE (top-right), SW (bottom-left), and SE (bottom-right). The top edge is labeled 'N' (North) and the bottom edge is labeled 'S' (South). The left edge is labeled 'W' (West) and the right edge is labeled 'E' (East). A north arrow is located on the right side of the grid, pointing upwards, with the letter 'N' above it.

☐ Public	National Park / other Government Dept.
☐ Private	

Primary report

I.D. (I.D. Office Use only)

[illegible]

General Site Information

Closed Site

Shelter/Cave Formation

- ☐ Boulder
☐ Wind erosion
☐ Water erosion
☐ Rock collapse

Rock Surface Condition

- ☐ Boulder
☐ Sandstone platform
☐ Silica gloss
☐ Tessellated
☐ Weathered
☐ Other platform

Condition of Ceiling

- ☐ Boulder
☐ Sandstone platform
☐ Silica gloss
☐ Tessellated
☐ Weathered
☐ Other platform

Shelter Aspect

- ☐ North
☐ North East
☐ East
☐ South East
☐ South
☐ South West
☐ West
☐ North West

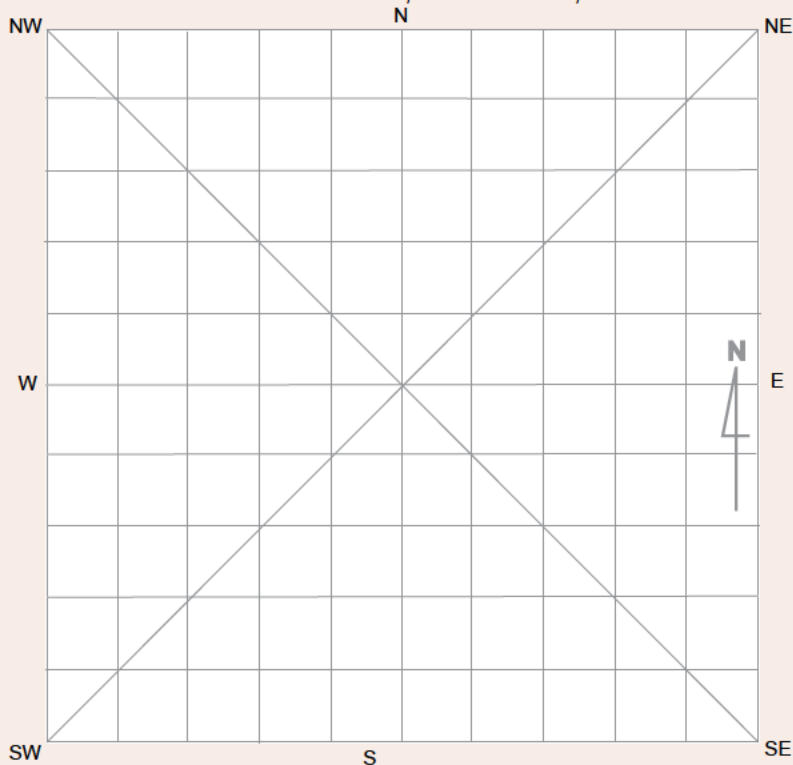
Open Site

Site Orientation

- ☒ N-S
☐ NE-SW
☐ E-W
☐ SE-NW
☐ N/A

Features

- ☐ 1. Aboriginal Ceremony & Dreaming
☐ 2. Aboriginal Resource & Gathering
☐ 3. Art
☐ 4. Artefact
☐ 5. Burial
☐ 6. Ceremonial Ring
☐ 7. Conflict
☐ 8. Earth Mound
☐ 9. Fish Trap
☐ 10. Grinding Groove
☐ 11. Habitation Structure
☐ 12. Hearth
☐ 13. Non Human Bone & Organic Material
☐ 14. Ochre quarry
☐ 15. Potential Archaeological Deposit
☐ 16. Stone Quarry
☒ 17. Shell
☐ 18. Stone Arrangement
☐ 19. Modified Tree
☐ 20. Water Hole

Site Plan Indicate scale, boundaries of site, features

Site Dimensions

Closed Site Dimensions (m)

- Internal length
 Internal width
 Shelter height
 Shelter floor area

Open Site Dimensions (m)

- 1.5m Total length of visible site
 1.5m Average width of visible site
 Estimated area of visible site
 Length of assessed site area

culturally significant

Site Cultural & Scientific Analysis and Preliminary Management Recommendations

1) E0412046 N6373942 Shell midden is approx. 15 x 15mtrs and is situated on the current cleared driveway area (not surfaced) approx. 2 metres from the NW corner of existing garage structure, adjoining and continuing to the south of a centred and raised garden bed and approx. 35 metres from northern boundary adjoining Nelson Bay Rd. Ground surface is flat and there is potential for subsurface deposits. Surface expression is low potential and subsurface is unknown.

2) E412038 N6373912 shell midden is approx. 35 x 35 mtrs located from the NE corner of the most southern rear shed (collapsed structure); in a direct northerly line to midden site 1 and existing unsurfaced driveway; to the SW of the garage structure and E of a large old growth tree. A small scattering of surface shell is visible in exposed surface areas. Some whole shell as well as broken shell. Surface expression is low potential and subsurface is unknown.

Endorsed by: ☐ Knowledge Holder ☐ Nominated Trustee ☐ Native Title Holder ☐ Community Consensus

Attachments (No.)

Comments

[illegible]

AHIMS site ID: 38-5-0347

Date recorded: 18-02-2019

Site Location Information

Site name: Anna Bay PAD 1

Easting: 412042

Northing: 6373398

Coordinates must be in GDA (MGA)

Horizontal Accuracy (m):

25

Zone: 56

Location method:

Non-Differential GPS

Recorder Information

(The person responsible for the completion and submission of this form)

Title

Surname

First name

Dr.

Disspain

Morgan

Organisation:

Niche Environment and Heritage

Address:

Phone:

0488774566

E-mail:

mdisspain@niche-eh.com

Site Context Information

Land Form
Pattern:

Dune Field

Land Use:

Mining

Land Form
Unit:

Dune

Vegetation:

Isolated clumps of trees

Distance to
Water (m):

1.23

Primary
Report:

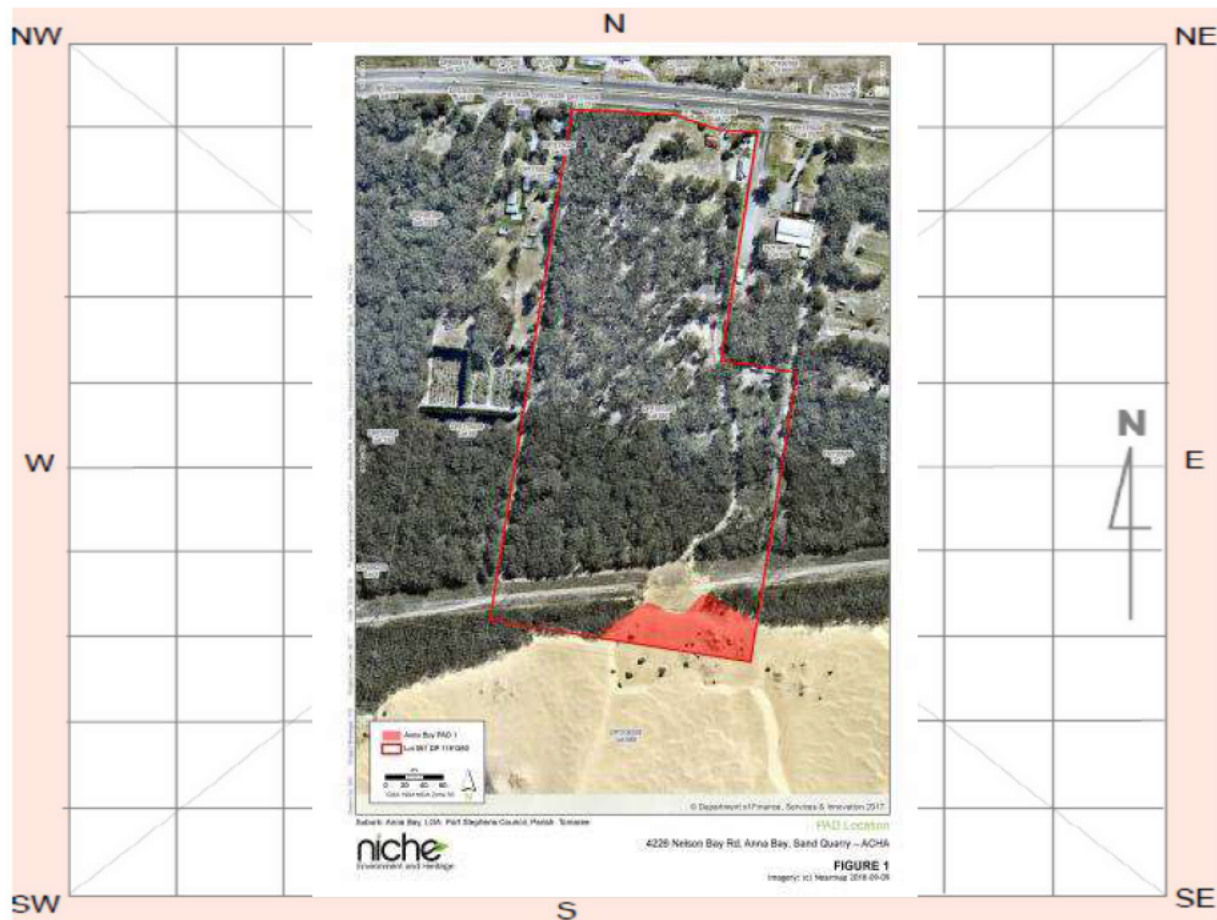
How to get
to the site:

The PAD is located within the southern portion of Lot591 DP1191380.
Access is through the lot, which is private property and requires
access permission. Address is 4226 Nelson Bay Road.

Other site
information:

A large, cleared and maintained transmission line easement is located
directly north of the PAD. Pad likely to have experienced disturbance
during easement construction, clearing of vegetation and aeolian
movement of dune system.

Site location map



Site contents information

open/closed site:

Open

Site condition:

Unstable Struct

Features:

1.

Potential Archaeological Deposit

Number of
features

Length of
feature(s)
extent (m)

180

Width of
feature (s)
extent (m)

60

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar shape

Tree Species

Description:

The PAD encompasses the immediate vicinity and foreground of a dynamic sand dune. The boundaries are determined by the Subject Area under assessment, and the PAD could extend beyond. The current coastline is located approx. 1.1 km to the south across a highly dynamic dune field.

Features:

2.

Number of
features

Length of
feature(s)
extent (m)

Width of
feature (s)
extent (m)

Scarred Trees

Scar Depth
(cm)

Regrowth
(cm)

Scar shape

Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
3.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
4.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Features:

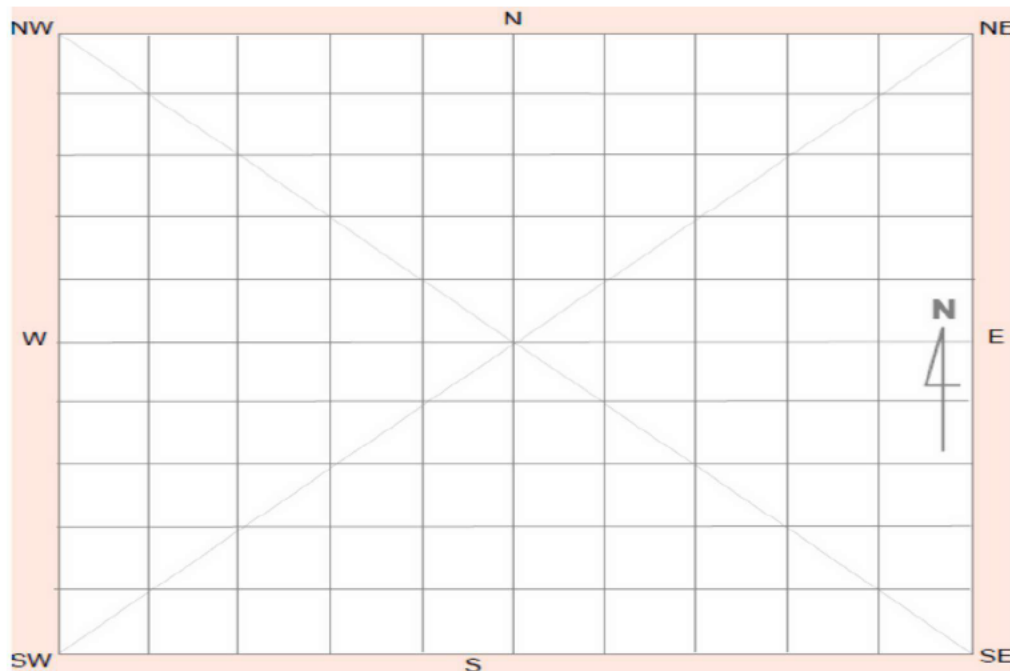
	Number of features	Length of feature(s) extent (m)	Width of feature (s) extent (m)
5.			

Scarred Trees			
Scar Depth (cm)	Regrowth (cm)	Scar shape	Tree Species

Description:

Other Site Info:

A large, cleared and maintained transmission line easement is located directly north of the PAD. Pad likely to have experienced disturbance during easement construction, clearing of vegetation and aeolian movement of dune system.

Site plan

Site photographs



Description: Anna Bay PAD1 dune surface facing west



Description: Anna Bay PAD1 dune surface facing east



Description: Anna Bay PAD1 transmission easement



Description: Ann Bay PAD dune ground surface

Site restrictions

Do you want to
Restrict this site?: ☐

Restriction type: Gender ☐ General ☐ Location ☐

Why is this site restricted?:

Further information contact

Title Surname First name

Organisation:

Address:

Phone: E-mail:

Appendix F: Historic Heritage Assessment



Anna Bay Sand Quarry

4226 Nelson Bay Rd Anna Bay

Historic Heritage Impact Assessment

Prepared for Hay Enterprises (NSW) Pty Ltd

1 March 2018

Document control

Project no.:	4017
Project client:	Hay Enterprises (NSW) Pty Ltd
Project office:	Sydney
Document description:	Heritage impact assessment
Project Manager:	Renée Regal
Authors:	Viki Gordon and Caitlin Marsh
Internal review:	Duncan Jones
Document status:	Draft
Local Government Area:	Port Stephens

Document revision status

Authors	Revision number	Internal review	Date issued
Viki Gordon and Caitlin Marsh	D 01	Duncan Jones	22 February 2018
Caitlin Marsh	D 02	Duncan Jones	1 March 2018

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Cover photograph: View north east along Mulgoa Road (Niche, 2017)

Niche Environment and Heritage

A specialist environmental and heritage consultancy.

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Illawarra

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Armidale

0488 224 094

Newcastle

0488 224 160

Mudgee

0488 224 025

Port Macquarie

0488 224 999

Brisbane

0488 224 036

Cairns

0488 284 743

Executive Summary

Tattersall Lander is preparing an Environmental Impact Statement (EIS) on behalf of Hay Enterprises NSW Pty Ltd (the proponent) to facilitate the development of a sand quarry behind Stockton Beach in Anna Bay. The Anna Bay Sand Quarry has been designated as local development under Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act) (the Project). As a Part 4 development, Secretary's Environmental Assessment Requirements were issued (SEAR 1172) which contain a condition to identify historic heritage in the vicinity of the development and assess the likelihood and significance of impacts on heritage items (if any).

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Tattersall Lander (the project manager) to undertake the present historic heritage assessment of the proposed development of a sand quarry over part of Lot 4266 Nelson Bay Rd, Anna Bay NSW (the 'subject site').

The subject site has been used as a small-hold farm property since European settlement in the region in the mid nineteenth century. The subject site is located abutting sand dunes, which are connected to the Port Stephens Local Environmental Plan (LEP) listed "Stockton Beach Dune System", an item of local heritage significance. The heritage curtilage for this item terminates approximately 3km to the west of the subject site. Also within two kilometres of the subject site are the following heritage locally listed heritage items: the Birubi Point Cemetery (LEP item I2). The subject site is also located two kilometres from the listed Aboriginal Place at Birubi Point. The subject site is also located to the east of the second site of the Hannah (later called Anna) Bay School building, but this is outside the curtilage of the subject site.

Due to the distance of the proposed activity from the listed heritage items, it has been concluded that no direct, indirect or archaeological impacts are likely to affect the surrounding heritage items. There are no further non-Aboriginal (historic) heritage constraints for the project to proceed.

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1. Introduction

1.1 Project background and aims

Tattersall Lander is preparing an Environmental Impact Statement (EIS) on behalf of Hay Enterprises NSW Pty Ltd (the proponent) to facilitate the development of a sand quarry behind Stockton Beach in Anna Bay. The Anna Bay Sand Quarry has been designated as local development under Part 4 of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act) (the Project). As a Part 4 development, Secretary's Environmental Assessment Requirements were issued (SEAR 1172) which contain a condition to identify historic heritage in the vicinity of the development and assess the likelihood and significance of impacts on heritage items (if any).

Niche Environment and Heritage Pty Ltd (Niche) was commissioned by Tattersall Lander (the project manager) to undertake the present historic heritage assessment of the proposed development of a sand quarry over part of Lot 4266 Nelson Bay Rd, Anna Bay NSW (the 'subject site').

This historic heritage assessment aims to satisfy the provisions of the Secretary's Environmental Assessment Requirements (SEARs 1172). The assessment seeks to meet the SEARs requirement for

"Identification of Historic heritage in the vicinity of the development and an assessment of the likelihood and significance of impacts on heritage items, having regard to the relevant and guidelines listed in Attachment 1."

The assessment has been prepared in accordance with the *NSW Heritage Manual*, particularly the *Statements of Heritage Impact* guidelines, published by the NSW Heritage Office and Department of Urban Affairs & Planning (1996, revised 2002), originally developed as part of the *NSW Heritage Manual*.

1.2 Project location

The project location is situated within the coastal semi-rural locality of Anna Bay, 12 km south west of Nelson Bay and 25 km north east of Newcastle Airport. The subject site is located in the Parish of Tomaree and in the County of Gloucester in the Port Stephens Council Local Government Area (Figure 1).

The subject site for the purposes of this assessment is defined as part of Lot 591 in Deposited Plan 1191380 (known as 4226 Nelson Bay Rd, Anna Bay). The location and extent of the subject site is shown in Figure 1 and Figure 2.

1.3 Proposed activity

The Proponent intends to establish a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period on the following basis:

- Sand will be extracted to ground level within the designated sand quarrying area (see Figure 2). Sand will be removed as it moves in a transgressional sand sheet from the dune system into the transmission line within the subject site. No ground surface disturbance will occur as a result of the quarrying activity.
- A front end-loader will load sand to trucks-and-dogs and remove directly from site per demand:
 - Approximately 910 cubic metres of sand per day up to a maximum threshold of 50,000 cubic metres a year (for a maximum of 30 years). This equates to approximately 55 full days a year of sand movement undertaken by 35 tonne trucks at a rate of 40 trucks per day.
- As a result of current sand movement encroaching into the subject site, vegetation is being smothered as the sand moves north. While the sand mine is in operation vegetation will be removed from the

dune and then mulched and used as ground cover within the caretaker's residence/ machinery shed compound as soil improver.

- A Caretaker's residence and machinery shed would be constructed for the project, the location of which is indicated in Figure 2. The buildings would be constructed on cement slabs for minimal ground disturbance. The land where the new buildings would be constructed will need to be primary cleared of native vegetation.
- Any vegetation removed for the purposes of construction of new buildings, intersection upgrades and site access improvements would be mulched on site and redirected to the area around the caretaker's residence/site office and machinery shed for soil improvement purposes.
- The existing access road will be widened to up to 6 m and consist of basic gravel construction (unsealed) with adequate drainage; limited ground disturbance is expected for minor drainage purposes. There is no proposal to excavate into the existing road as fill will be used to level the road.

1.4 Project scope and report outline

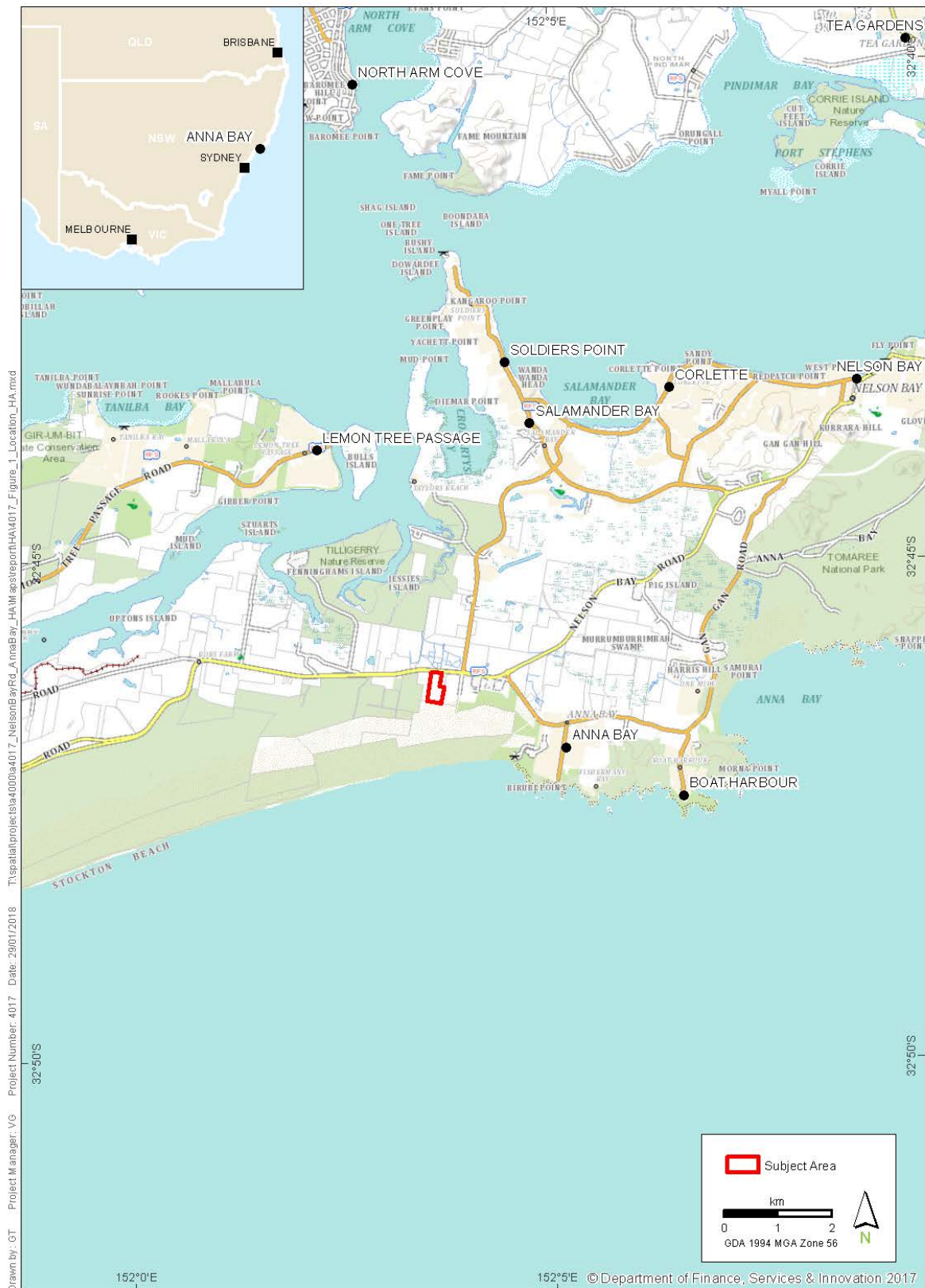
To complete this historic heritage assessment, the following tasks were undertaken:

- Identification of relevant State and local heritage planning controls that would be relevant to the Project (Section 2).
- Limited historical research to understand the past land use and heritage values of the subject site and surrounding area (Section 3).
- Identification of significance (Section 4).
- Site inspection of the subject site to assess any potential impacts (Section 5).
- Impact assessment of the proposed development on the heritage values and significance of the Stockton Beach Dune System (Section 6)
- Provision of management recommendations (Section 7).

1.5 Authorship and acknowledgements

This report was written by Caitlin Marsh (Heritage Consultant, Niche) with input and review by Duncan Jones (Senior Heritage Consultant, Niche).

Figure 1: General location of the subject site.



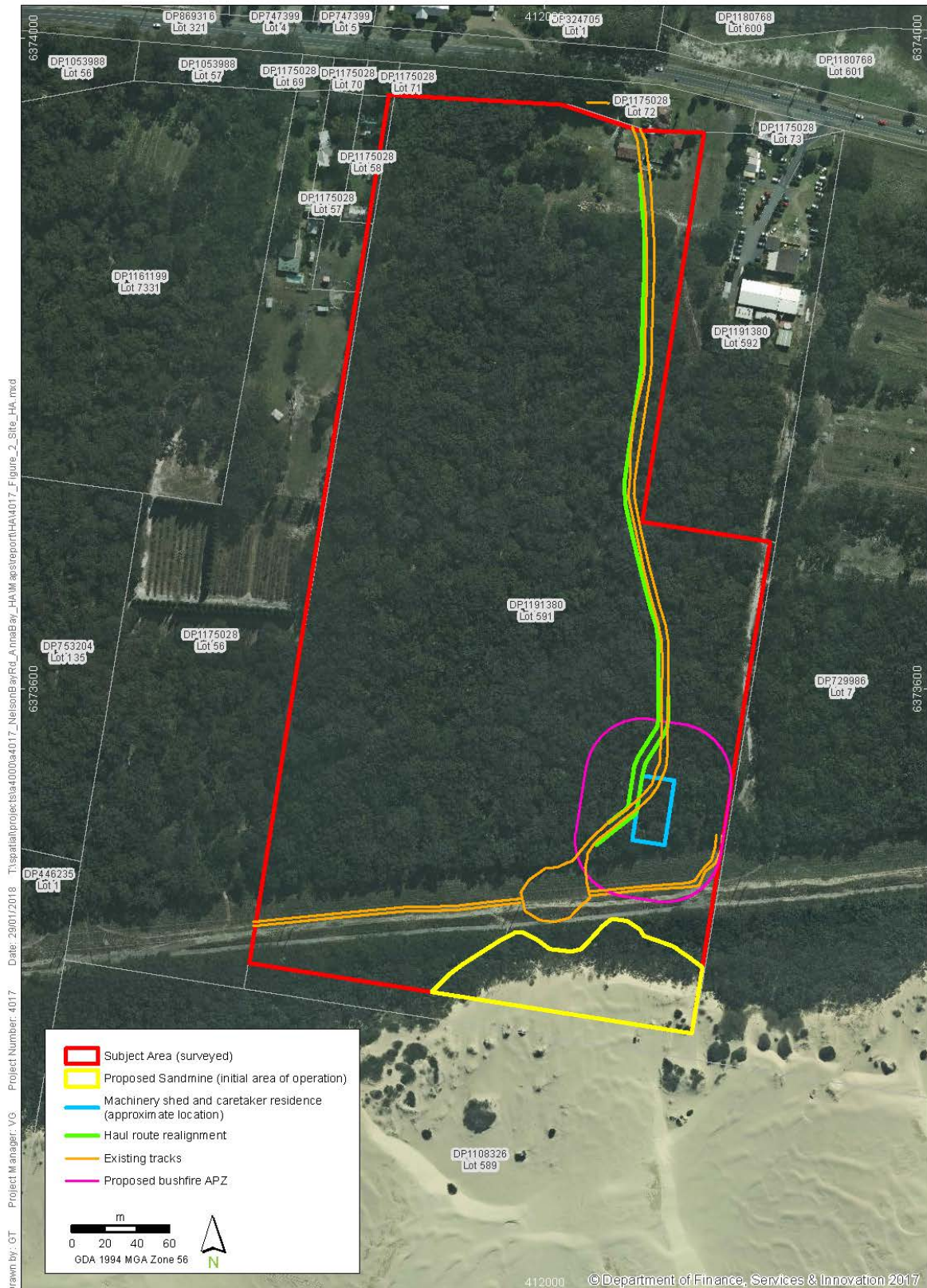
Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Location map

Anna Bay Sand Quarry Historic Heritage Assessment

FIGURE 1

Figure 2: Location and Extent of the Subject site



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Subject Area

Anna Bay Sand Quarry Historical Heritage Assessment

FIGURE 2

Imagery: (c) LPI 2012-08-19

2. Regulatory and Assessment Framework

2.1 Preamble

The following subsections present a summary of relevant State and local legislation and associated planning instruments designed to conserve significant heritage items and their values. The results of heritage register searches undertaken on 1 February, 2018 are also presented in the relevant subsections and are shown in Figure 3.

2.1.1 National and Commonwealth Heritage Registers

Under the EPBC Act Amendments (No. 88, 2003), two mechanisms have been created for the protection of heritage places of National significance

(<http://www.environment.gov.au/heritage/places/national/index.html>) – the National Heritage List (NHL) and the Commonwealth Heritage List (CHL). The NHL provides protection to places of cultural significance to the nation of Australia, while the CHL comprises natural, Aboriginal and historic heritage places owned and controlled by the Commonwealth.

The Register of the National Estate (RNE) is a non-statutory list of important places maintained by the Commonwealth as a publicly available archive and educational resource. The existence of an entry for a place in the RNE does not in itself create a requirement to protect the place under Commonwealth law. Nevertheless, information in the RNE may continue to be current and may be relevant to decisions about protection and management.

The Australian Heritage Database (AHD) is maintained by the Department of Environment and Energy (DoEE). The AHD contains includes records of CHL, NHL and RNE places.

A search of the AHD was undertaken on 31 January 2018. There are no items within the subject site listed on CHL or the NHL. One item adjacent to the subject site is listed on the RNE:

Table 1: National heritage register results in proximity to the subject site

Item Name	Register	Place No.	Address	Property Description	Legal Status
Newcastle Bight Coastal Area	RNE	19510	Nelson Bay Road, Fern Bay, NSW	Coastal embankment stretching from Birubi Point to the Hunter River Estuary	Indicative

2.1.2 NSW Heritage Act 1977

The *NSW Heritage Act 1977* is a statutory tool designed to conserve historic and environmental heritage in NSW. It is used to regulate development impacts on the State's historical heritage assets. The Act defines a heritage item as 'a place, building, work, relic, moveable object or precinct'.

To assist with the management of the State's heritage assets, the Act distinguishes between items of Local and State heritage significance:

'Local heritage significance', in relation to a place, building, work, relic, moveable object or precinct means significance to an area in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

‘State heritage significance’, in relation to a place, building, work, relic, moveable object or precinct means significance to the State in relation to the historical, scientific, cultural, social, archaeological, architectural, natural or aesthetic value of the item.

Archaeological features and deposits are afforded statutory protection by the relics provisions of the Act (as amended in 1999). S.139 [1] states that:

A person must not disturb or excavate any land knowing or having reasonable cause to suspect that the disturbance or excavation will or is likely to result in a relic being discovered, exposed, moved, damaged or destroyed unless the disturbance or excavation is carried out in accordance with an excavation permit.

Table 2: State heritage listed items near the Subject site

Item Name	SHR #	Gazettal date.	Address	Property Description	Significance
Birubi Point Aboriginal Place	5062849	20.04.2007	Anna Bay, NSW	Tomaree National Park	State (NPW Act)

2.1.3 NSW Environmental Planning & Assessment Act 1979

The *NSW Environmental Planning and Assessment Act 1979* (EP&A Act) establishes the framework for cultural heritage values to be formally assessed in the land use planning and development consent process and requires that environmental impacts are considered prior to land development; this includes impacts on heritage items. The Act also requires that local governments prepare planning instruments (such as Local Environmental Plans) in accordance with the principles of the legislation to provide guidance on the level of environmental assessment required.

2.1.4 State Environmental Planning Policies

The EP&A Act makes provision for the preparation of State Environmental Planning Policies (SEPP’s) that may, in certain circumstances, over-ride the provisions of a LEP. The State and Regional Development SEPP 2011 is relevant to the current Project.

2.1.4.1 State Environmental Planning Policy (State and Regional Development) 2011

The State Environmental Planning Policy (State and Regional Development) 2011 replaced the former Part 3A major projects requirements of the EP&A Act. This SEPP identifies development that would be considered State significant development, State significant infrastructure and critical State significant infrastructure and has created two approval pathways:

- State Significant Development, e.g. mining, petroleum (oil, and gas), intensive livestock agriculture, chemical, manufacturing and other industries; and
- State Significant Infrastructure, e.g. port facilities and wharf or boat facilities, road and rail infrastructure, water storage or water treatment facilities.

For SSI and SSD declared projects, an Environmental Impact Statement (EIS) is required.

2.1.5 Port Stephens Local Environmental Plan 2013

Each Local Government Area (LGA) is required to create and maintain a Local Environmental Plan (LEP) that identifies and conserves Aboriginal and historical heritage items. The Port Stephens LEP came into effect in 2014.

The heritage provisions of the Port Stephens LEP are set out under Clause 5.10. The LEP recognises individual buildings, sites, places, archaeological sites and landscapes of both State and local significance as specific heritage items within Schedule 5. The LEP also lists heritage conservation areas which cover one or many built or landscape items that are listed in their own right. These are also listed in Schedule 5 of the LEP.

According to this Clause, the consent authority may require a heritage impact assessment be carried out if the proposed development is within the vicinity of land where a heritage item is situated (Clause 5.10 Subclause 5).

Before granting consent, Port Stephens Council must consider the effect of the proposed development on the heritage significance of the item or area concerned. Council may require a heritage management document to be prepared that assesses the extent to which the carrying out of the proposed development would affect the heritage significance of the heritage item or heritage conservation area concerned.

Under the Port Stephens LEP 2013 there are no listed heritage items within the subject site.

Table 3: Heritage listed items near the subject site

Item Name	Item No.	Address	Property Description	Significance
Birubi Point Cemetery	I2	Beyond rear boundary of 31A & 33A, 31B Ocean Avenue, Anna Bay	Tomaree National Park - DP 753204; Lot 7035, DP 1057295	Local
Stockton Beach Dune System	I34	4480 Nelson Bay Road, Anna Bay	Between Stockton and Anna Bay	Local

2.1.6 Port Stephens Development Control Plan 2014

The Port Stephens Development Control Plan (DCP) outlines detailed local provisions for all land within the Port Stephens LGA. These guidelines are in addition to the provisions of the Port Stephens LEP. Section B8 of the DCP states requirements that apply to all development within heritage items and heritage conservation areas and also specific, unique requirements for development within each particular area. The DCP contains controls for any developments that may impact on a heritage item.

There are no specific heritage controls within the Port Stephens DCP 2014 that apply to the project.

Figure 3: Heritage Items within proximity to the subject site (Source: Niche and LPI)



Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

Heritage Items in relation to the Subject site
Anna Bay Sand Quarry Aboriginal Heritage Assessment
FIGURE 3

3. History

3.1 Preamble

The following subsections present a brief summary of historical development of the subject site and Anna Bay more broadly.

3.2 Anna Bay and surrounds



The Stockton Bight was first noted by Captain James Cook in 1770 and later mapped by Lieutenant John Shortland in 1797. Settlement Anna Bay is located at the north-eastern end of Stockton Beach in the Hunter Region of New South Wales. It is located on the southern side of Port Stephens which is located to the south of the one million acre land grant to the Australian Agricultural Company (A A Co) (see Figure 4). William Cromarty, who was involved with the A A Co settled outside of the Company's holding at Soldier's Point which is north of Anna Bay (ABPS 2014).

The first European settlement in the area involved the establishment of dairy farms, which were constrained to the low-lying areas of Anna Bay in the 1830s (HLA 1995). An unsealed government road, which became the current Nelson Bay Road was established that linked Stockton with Nelson's Bay in the mid nineteenth century, but regular use of the road by cars did not occur until the 1920s (OEH 2015:26).

During World War II, the road between Stockton and Anna Bay was improved and greater access encouraged more activity to occur in the area, such as holiday accommodation and residential and tourism development (OEH 2015: 26). Sand mining for heavy minerals commenced in 1968 at Anna Bay (located to the east of the subject site; see Figure 4), with other mines opening in Salamander, Bobs Farm, Tanilba, Oyster Cove, Williamtown and Medowie from the 1950s on (Bartlett 1980).

Figure 4: 1985 aerial photo showing the sand quarry and Birubi Point Cemetery (Source LPI)



Figure 5: Plan of the Australian Agricultural Company's grant at Port Stephens 1828 [cartographic material] / engraved by J. Cross 18 Holborn London Online images available via the State Library of NSW at: <http://acms.sl.nsw.gov.au/album/albumView.aspx?itemID=9>

3.2.1 Birubi Aboriginal Place

Birubi Point, which is located 1.4 km the east of the subject site is a registered Aboriginal Place due to its continued association with the Worimi people. It was registered as an Aboriginal Place 5062849 (file

number 07/18962 & DOC 07/50249 & DOC1) under the National Parks and Wildlife Act in 2007. It is a traditional Aboriginal ceremonial and burial site which contains extensive archaeological material which is important to the teaching of the current and future generations about the local Aboriginal culture. This site is connected with the Worimi Conservation Lands, which are a joint management of a number of National parks and conservation areas that. For a more detailed assessment of the Aboriginal Place, please refer to the Aboriginal preliminary assessment prepared by Niche (2018).

3.2.2 Birubi Point Cemetery

Birubi Point is located approximately 2.3 km from the subject site. Birubi Point Cemetery was in use between 1876 and 1996 and contains the graves of early settlers to the area as well as shipwrecked persons, some of who were unidentified. The cemetery is located adjacent to the original lot of land settled by the Blanch family in the 1950s. The point on which the cemetery is located was known as Cemetery Point, until the name was officially changed in 1976 and it is now located within the lands of the Birubi Point Aboriginal Place. The first internment in 1876 was that of Lucy Blanch who was an Anna Bay pioneer. The cemetery contains a layout plan on a plaque and includes a list of all the known burials within the cemetery, numbering 88 internments.

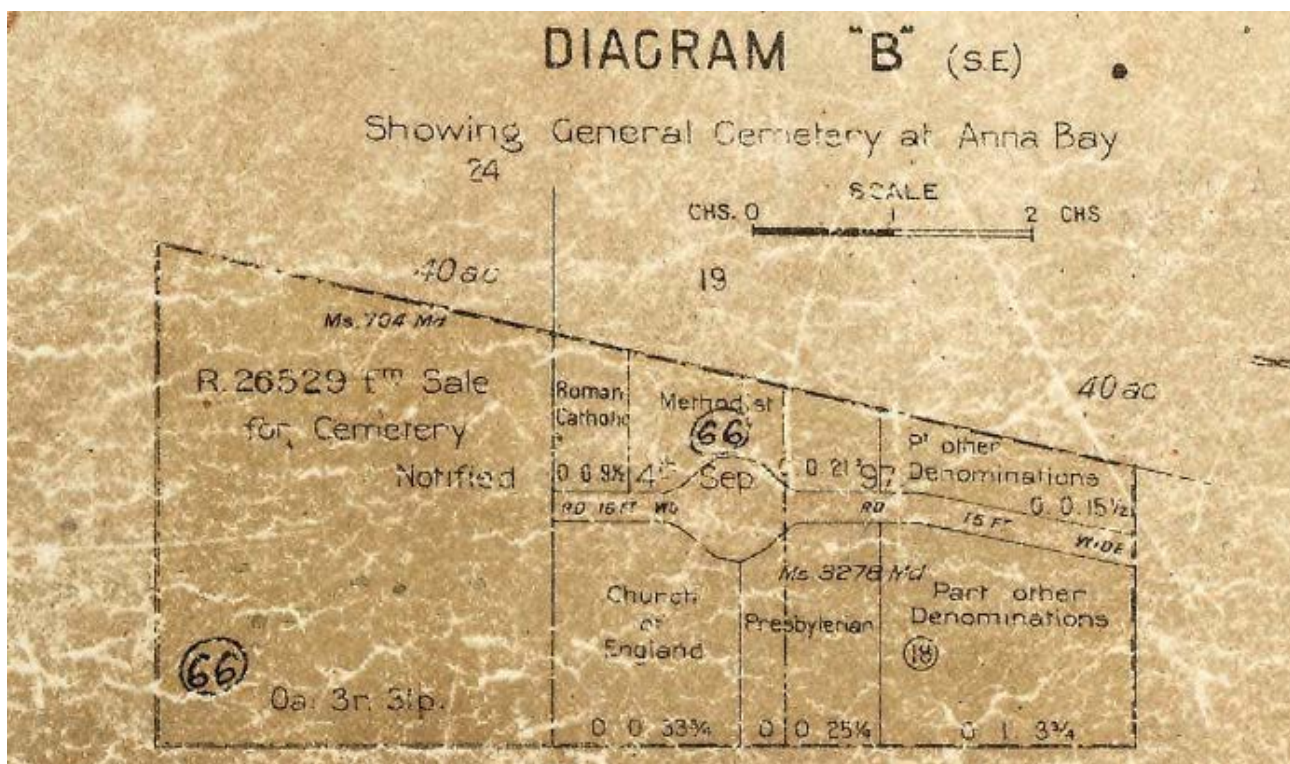


Figure 6: Insert from the 1967 Tomaree Parish map showing the layout of the Birubi Cemetery.

3.3 Stockton Beach Dune System

Stockton Beach dune system is the largest moving coastal land mass in the southern hemisphere, and stretches from Stockton to Anna Bay covering a distance of approximately 25 kilometres in length. The dunes are moving inland at a rate of about one metre per year, following their destabilisation in the nineteenth century by severe storms and cattle grazing. According to the Register of the National Estate, the entire bight (stretching from the Hunter River Estuary to Birubi Point in the north) is of significance for its unique natural ecosystem (RNE Place ID: 19510).

As a result of the shifting sand sheet, Aboriginal midden sites, burials and education sites important to the Worimi peoples, as well as World War II fortifications, are periodically covered and revealed by the moving

sands. The defence lines that were constructed on Stockton Beach during World War II were part of the Northern Defence Line, which was a part of the nationwide response to the Japanese attacks on Darwin and submarines entering Sydney and Newcastle harbours (OEH 2015:27). The defensive tank traps were set up along the entire line of the beach, and infantry-manned heavy and light artillery stations were established at the southern end of the beach at Fern Bay. Tank traps which were removed from their emplacements now form the boundaries of an overflow carpark just below Birubi Point at the northern end of the beach. The northern end of the beach, located south of Birubi Point was used as a bombing and military training location during World War II (OEH 2015:27). The weapons range, which was established during the war with an area approximately totalling 400 hectares, including an area directly to the south of the subject site. The area continued to be used as a RAAF weapons range until at about 1965 (see Figure 5). Unexploded ordinance is still recovered from the sand dunes and are subject to protocols from the NSW Police and Department of Defence (OEH 2015:27).

Located within the central section of the beach, behind the foredune, are a group of eleven corrugated iron structures with gable or skillion roofs. They have been named “Tin City” by the locals. The original huts date to the 1940s and 50s and were constructed for use by recreational fishermen in the area. The majority of the huts that are currently standing were constructed in the 1970s and 1980s, with the most recent hut constructed in 1992. None of the original huts from the 1940s and 1950s are still standing, but those that remain continue to be used by fishermen (OEH 2015:28). The remains of destroyed huts on the southern and central areas of the beach remain under the shifting sand dune, subject to exposure by local sand drift.

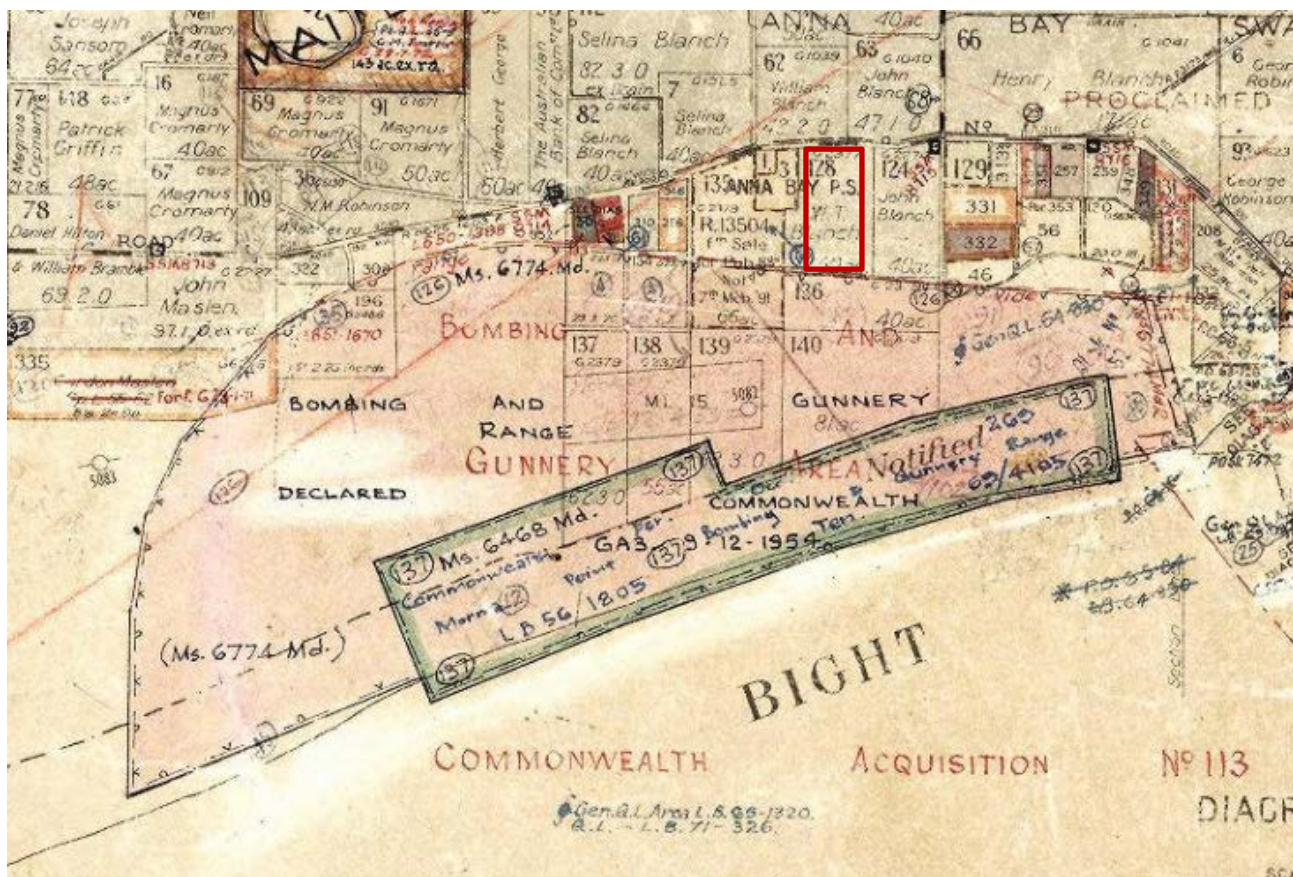


Figure 7: 1967 Tomaree parish map outlining "bombing and gunnery range" abutting onto the subject site (indicative location shown in red). (Source: LPI)

3.4 The Subject Site and surrounding area

The subject site is located within a land grant belonging to a W. T. Blanch, who is likely John and Lucy Blanch's son William, born in 1863. The Branch family owned much of the land within the Anna Bay area in the earliest days of European settlement, from at least the 1850s (ABPS 2014:5). It is unknown, from documentary evidence what activities took place within the subject site, but it has remained predominately uncleared of native vegetation until the present day.

The subject site is also located adjacent to the second (and third) Anna Bay Public School buildings (known until 1896 as Hannah Bay Public School). The first school was gazetted in September 1879 and the proposed structure was a slab and bark hut capable of holding twenty pupils. The school was located within William Blanch's land fronting the government road on the northern side of the current Nelson Bay Road (Joe Robinson 1907 quoted in ABPS 2014:23). Construction of the first school was completed in November 1879. When this primitive structure was outgrown, a new plot of land was purchased south of the government road a new school was constructed in 1884. The school was a rounded roof structure made of corrugated iron. It had a verandah and an internal stepped floor with long bench desks which allowed the pupils and teachers to see each other more clearly. This school was demolished and replaced by a new structure in 1910 within the same plot. The newer building consisted of a 21 feet squared hipped roof building with a verandah with a flat floor. The remains of the second school were used to construct a lean-to within the school grounds (ABPS 2014). The school building is visually separated from the subject site by a later subdivision.

3.4.3 Modern Development

There are two garage buildings and a gabled roof building present fronting the road on 4226 Nelson Bay Road, in the earliest 1963 aerial available (see Figure 7). Directly to the west of the building group, within the subject site is a cleared and cultivated field. There are long, probably farm related structures running east-west across the property, approximately to the house and barns fronting the road. To the west, outside of the subject site, are a series of residential buildings (4206-4210 Nelson Bay Road) constructed between the subject site and the potential school building identified in on 4202 Nelson Bay Road (see Figure 7). To the east of the subject site is a carpark, market building and the 'Baylife Church'. An unformed, cleared track through the native vegetation, most likely relating to the transmission line runs near the southern boundary of the subject site. It was most likely developed following the cessation of the RAAF activities to the south of the subject site.

In 1985, the east-west farm building located to the south of the main domestic building within the subject site has been demolished and the majority of the cleared farm paddock to the west of the domestic building has regrown vegetation. It should also be noted that the sand has encroached towards the transmission line from the south, where it was not visible before. The transmission line has also been cleared and a gravel road surface added.

In 2015 Nelson Bay Road was widened and straightened, which meant that the residential dwelling present in the 1963 aerial was demolished. The remaining three garage buildings are located fronting the road now. The access track, which is proposed to be widened prior to mining commencing starting from between the garage buildings.



Figure 9: Aerial photo from 1963 showing the possible location of the second school building, and the cluster of structures within the subject site (approximately outlined in blue)



Figure 10: 1985 aerial with the approximate subject site outlined in blue

4. Site description and setting

4.1 Preamble

An inspection of the subject site was conducted on 23 January 2018 by Viki Gordon (Senior Heritage Consultant, Niche). The inspection involved field survey of the impact footprint for the proposed development in its entirety. Photographs were taken, and any observations noted.

The subject site is contained within Lot 591 in Deposited Plan 1191380 (known as 4226 Nelson Bay Rd, Anna Bay). The subject site is area affected by the impact footprint outlined in Section 1.3 and detailed in Figure 2). The lot is largely undeveloped and located on a vegetated sand dune. The subject site is constrained by its location within the pre-cleared and modified access track and transmission line easement. There is very little vegetation within the greater proportion of the subject site, along the access track. Vegetation clearance and the subsequent construction of a residence, garage and in-ground pool had previously taken place in the area adjoining the Nelson Bay Rd street frontage and limited to the north east corner 150 m (see Figure 1). Adjacent to the proposed impact footprint, is uncleared vegetation, it is also present within the footprint for the proposed caretaker's residence and work shed.



Figure 11: Original development and street frontage, prior to road widening (Source sixmaps.nsw.gov.au)

In 2015, a proportion of the street frontage was resumed by Roads and Maritime for the purposes of widening Nelson Bay Rd. The road was widened from approximately 9m wide to 21m, and it was straightened to resume an additional 10m of the street frontage of the subject site, creating an impact footing of approximately 29m. As part of this resumption, the existing residence and in ground pool were demolished and infilled. Figure 10 shows the existing street frontage and remaining garage structure.



Figure 12: Current street frontage showing the modification to the street and demolition of the original house in plan view (Source Tattersall Lander)

4.2 Nearby Heritage Items

The only heritage item within close proximity to the subject site is the Stockton Bight Dune System. The heritage curtilage for this item terminates approximately 3 kilometres to the west of the subject site. The sand dune system abuts the subject site, but this area is not included in the gazetted heritage curtilage. Due to the nature of the shifting sands, as noted in Section 3.3 sand moves from within the protected area of the dunes, northward, so the sand moving into the subject site may have come from within the Stockton Bight Dune System curtilage.

4.3 Archaeological Potential

As noted on the 1963 aerial of the property, there is a cluster of buildings located close to the original street frontage on Nelson Bay Road. They are visible on the 1963 aerial (see Figure 7), so were constructed prior to this date. There is a hipped roof residential building located closest the original road alignment. This building was demolished between September 2013 and January 2014 to allow for the widening and straightening of Nelson Bay Road. There are also three garage buildings with corrugated roofs south of the dwelling that are still standing.

Also visible in the 1965 aerial is an elongated rectangle building with a flat roof at the southern end of the cleared paddock to the south and south west of the dwelling and garage buildings. This rectangular building has been demolished by 1985 and has been replaced by a small rectangular building. This building has also been demolished at around the same time as the dwelling in the road corridor. These corrugated roofed buildings likely relate to the farming practices visible in the 1963 aerial.

No other buildings are visible within the subject site, the only other works located within the area are clearing for the unformed vehicle track (which is established and cleared after 1985) and the electricity easement which is located in the southern third of the subject site. The easement route is present in the 1963 aerial, but there is no noticeable electricity infrastructure within the cleared easement, it appears to just be an unformed track.

The former rectangular buildings to the south- and south-west of the garage buildings, which were demolished in 2013/2014, may have left sub-surface remains following its demolition. However, artefactual

or subsurface structural material associated with twentieth century farming practices would not meet the threshold for local heritage significance.

As such, the archaeological potential for significant relics at the subject site is nil.

5. Assessment of Significance

5.1 Significance framework

The *NSW Heritage Manual* guideline, 'Assessing Heritage Significance' (NSW Heritage Office 2001) provides the framework for the following significance assessments and Statements of Significance. These guidelines incorporate the seven aspects of cultural heritage value identified in the *Australia ICOMOS Charter for Places of Cultural Significance, The Burra Charter, 2013* (Burra Charter) into a framework currently accepted by the NSW Heritage Council. Following the results of the background reviews, historical research and site inspections, significance assessments for identified heritage items are presented in the subsections below.

5.2 Significance assessment for the Stockton Beach Dune System

A heritage significance assessment of the Stockton Beach Dune System is provided in Table 4 below.

Table 4. Assessment of heritage significance for the Stockton Beach Dune System

Criterion	Significance
<i>(a) An item is important in the course, or pattern, or NSW's cultural or natural history (or the cultural or natural history of the local area)</i>	The dune system is important to both the cultural and natural history of the local area as it is an indicator of changed in weather over time since the Quaternary period and as an important place for the Worimi people. The heritage item has local significance under this criterion.
<i>(b) An item has strong or special associations with the life or works of a person, or group of persons, of importance in the cultural or natural history of NSW (or the cultural and natural history of the local area)</i>	The sand dune contains shell middens, relics relating to shipwrecks, tin huts, and World War II fortifications including tank traps, barbed wire, observation posts and an aeroplane crash. The Tin City has specific association with recreational fishing on the beach, as they are continually used by current fishermen. The heritage item has local significance under this criterion.
<i>(c) An item is important in demonstrating aesthetic characteristics and/or a high degree of creative or technical achievements in NSW (or the local area)</i>	The sand dunes have aesthetic characteristics due to their large scale showcase of unique natural formations and ecological communities. The heritage item has local significance under this criterion.
<i>(d) An item has a strong or special association with a particular community or cultural group in NSW (or the local area) for social, cultural or spiritual reasons.</i>	It is socially significant to the Worimi people, as it is part of the Worimi Conservation Lands, and contains recorded shell middens The heritage item has local significance under this criterion.
<i>(e) An item has potential to yield information that will contribute to an understanding of NSW's cultural or natural history (or the cultural or natural history of the local area)</i>	The sand dunes make an important contribution to the area's natural history as they are a representative example of dual barrier sand dunes which were formed in relation to sea level changes during the glaciation of the late Quaternary. The outer barrier sand dune system is an area of marine transgression and progradation which occurred following the end of the sea level rising (6500 years to 6000 before the present). The heritage item has local significance under this criterion.

Criterion	Significance
<i>(f) An item possesses uncommon, rare or endangered aspects of NSW's cultural or natural history (or the cultural or natural history of the local area); and</i>	The dune system is said to be the largest mobile sand mass in the southern hemisphere. It is a well preserved example of a dual barrier system. It have been subject to overuse by four wheel drive vehicles. The heritage item has local significance under this criterion.
<i>(g) An item is important in demonstrating the principal characteristics of a class of NSW's: Cultural or natural places; or Cultural or natural environments; (or a class of the local area's) Cultural or natural places; or Cultural or natural environments.</i>	The Stockton Beach sand dunes are representative of a specific kind of barrier dune system that is unique to Australia in this area. The heritage item has local significance under this criterion.

5.3 Statement of Significance

The following statement of significance is adapted from the heritage inventory sheet completed for the Port Stephens Local Environmental Plan (Item No: I34) and the Register of the National Estate listing (Place ID: 19510):

The Stockton Sand Dune System is of local significance for both its natural and cultural criteria. It is the largest mobile dune system in Australia which provides evidence for environmental change over the last 150,000 with particular emphasis on changes caused by climate change. Various native flora and fauna are native to the area, including three species of rare orchid.

The cultural significance of the area extends from its use by the Worimi people to travel and their connection to the ocean, nearby estuarine and forest habitats, and stone tool sources. Hundreds of recorded Aboriginal sites exist within the sand dunes, the majority of these sites are shell middens and there are recorded burials and repatriated burials within the sand dune system.

Located within the sand dunes are remnants of World War II fortifications including tank traps and a rifle range, which are exposed and covered by the moving sands. A 'Tin City' is located within the centre section of the beach which shows continued association with recreational fishermen since the 1940s and 1950s.

6. Heritage Impact Assessment for Stockton Beach Dune System

6.1 Introduction

The following subsections assess potential impacts of the proposed works on the heritage significance of Stockton Beach Dune System heritage item (SHI #2280081; LEP listing I34).

The *Statements of Heritage Impact* guidelines (NSW Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002) pose a range of questions for consideration when assessing heritage impacts. Of relevance to this assessment are questions concerning new landscape works and features, which are addressed below.

6.2 Proposed Activity

The Proponent intends to establish a sand quarry to extract a maximum of 50,000 cubic metres of sand in any year over a 30 year period. The main impacts of the development proposal are depicted in Figure 2 and will be:

- The extraction of sand to ground level
- Removal of vegetation for the purposes of the caretaker's residence/site/office/machinery shed; intersection upgrade and site access improvements (haul road)
- Construction of a caretaker's residence/site office and machinery shed which will be a slab construction with minimal earth impact
- The existing access road will be widened to 6m (pending Council and other authority comments) and consist of basic gravel construction (unsealed) with adequate drainage; other than for minor drainage purposes. There is no proposal to excavate into the existing road
- Following the cessation of quarry activity, the back slopes of the dunes will be re-vegetated to attempt to stabilise the sand and replace the vegetation removed during the mining process.

6.3 Potential impacts to heritage items

6.3.1 Direct (physical) heritage impacts

The proposed activity will involve the extraction of sand up until the southern property boundary, this will cut into the existing sand dune profile, but it will not cut into the heritage listed portion of Stockton Beach Dune System. The mine will remove sand, as it moves from the beach into the electricity easement. Rehabilitation procedures, including revegetation will be undertaken in the quarry area to stabilise the sand. The sand extracted by the mine could have originally come from the listed portion of the dune system, but as it has moved from outside the curtilage and the sand will be cleared from the existing transmission line easement.

The activity will not cause any impact upon the Stockton Beach Dune System, as the subject site is located outside of the heritage curtilage of the item.

The original Anna Bay School building, which is noted in Section 3.7 is located to the west, outside the boundary of the subject site. The school site is not listed on any heritage register and it is unlikely that any buildings associated with it are located within the subject site. No other heritage items are located within distance where they would be physically impacted, including the Birubi Point Cemetery (LEP item I2), or the Stockton Beach Dune System (LEP item I34). The proposed sand mine is also located outside of the curtilage of the Birubi Point Aboriginal Place.

6.3.2 Indirect (visual) heritage impact

There will be no visual impact from the proposed activity onto Stockton Beach Dune System, as the sand is being removed from the back of the current barrier dune with battering to be constructed following the geotechnical assessment. The caretaker's house and associated buildings will be sheltered from view from the beach by the remainder of the sand dune that will not be quarried.

Due to the distances of the proposed activity from the other heritage items in the area (including Birubi Point Cemetery, and Birubi Point Aboriginal Place) there are no anticipated heritage impacts to these items. Birubi Point Aboriginal Place and Birubi Point Cemetery are located 3 km away from the subject site and would only be able to see the rear of the sand dune from which the quarry will be extracting from.

Following the completion of quarry activities, the back slope of the sand dune will be re-vegetated with local vegetation to stabilise further erosion and dune movement. This will not be visible from the curtilage of the Stockton Dune System, Birubi Point Aboriginal Place, or Buribi Point Cemetery as it will be at the back of the dune.

As the proposed works would not introduce any new visual elements into the landscape, the visual heritage values of nearby heritage items would not be impacted. The proposed works would therefore result in negligible impacts to these heritage items.

6.3.3 Potential archaeological impacts

There has been minimal development within the subject site and the property has been used primarily for small semi-rural farming. The original residential dwelling identified in Section 4.1 has been demolished and the associated garage and outbuildings remain facing Nelson Bay Road. The former Anna Bay Public School is located on a separate lot to the east of the subject site.

There are no identified areas of heritage significant archaeological potential at the subject site, and therefore ground disturbance in this area would not result in any impacts to archaeological relics.

Table 5: Summary of potential impacts to the heritage items from proposed e sand quarry works

Item	Direct	Indirect	Archaeological
Extraction of sand to ground level	Neutral	Negligible	Neutral
Vegetation removal	Neutral	Negligible	Neutral
Construction of caretaker's cottage/site office and machinery shed	Neutral	Negligible	Neutral
Widening of existing access track	Neutral	Negligible	Neutral

6.3.4 Statement of Heritage Impact

A summary Statement of Heritage Impact is provided in Table 3 below, as per the 'Statements of Heritage Impact' guidelines (NSW Heritage Office and Department of Urban Affairs & Planning 1996, revised 2002).

Table 6. Statement of heritage impact.

Aspects of the proposal that respect or enhance the heritage significance of the heritage conservation area	The proposed activity would not result in any direct impacts to the heritage significance of Stockton Beach Dune System nor impact any likely historical archaeological resources.
Aspects of the proposal that could detrimentally impact on heritage significance	The subject site is located s outside the gazetted curtilage for Stockton Beach Dune System. The sand will be extracted from the moving transgressive sand sheet, and not extracted from the body of the sand dune. These works would not be noticeably prominent in the landscape, and would not introduce significant intrusive fabric or overshadow any nearby heritage items. As such there will be no detrimental direct or indirect impacts from the proposed activity because it is outside the curtilage for the dune system.
Have sympathetic solutions been considered and discounted?	As no adverse heritage impacts have been identified, no other sympathetic solutions have been considered necessary.

7. Conclusions and Recommendations

7.1 Conclusions

- There are no listed heritage items within, or directly adjacent to, the Subject Site.
- The subject site has been employed as a small farm-holding since the mid-nineteenth century, although no heritage significant built fabric has been identified at the site;
- No areas of archaeological potential for the recovery of heritage significant relics have been identified at the subject site.
- The proposed works would therefore not impact on any heritage significant items or archaeological relics. There are no further non-Aboriginal (historic) heritage constraints for the proposed works.

7.2 Recommendations

Based on the results of background heritage register searches, a visual assessment of the subject site, and an impact assessment prepared in accordance with the Statements of Heritage Impact guidelines published by the NSW Heritage Office and Department of Urban Affairs & Planning (1996, revised 2002) and best practice as outlined by the *NSW Heritage Manual* it is recommended that:

- In the event that historical archaeological relics are unexpectedly exposed during excavation, ground disturbance works should stop in the affected area and a suitably qualified historical archaeologist be engaged to assess the extent, condition and likely significance of the remains. Depending on the significance of the relics, notification of the discovery may be required in accordance with S.146 of the *Heritage Act 1977* and further approval may be required if impacts are proposed

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Annex 1 – Proposed Works Diagram



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Appendix G: Traffic and Transport Assessment



BETTER TRANSPORT FUTURES
MARK WAUGH



Anna Bay Sand Extraction Project

HAY ENTERPRISES (NSW) PTY LTD

Traffic Impact Statement
August 2018



Mark Waugh Pty Ltd

ABN 67 106 169 180

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1 Introduction

This Traffic Impact Statement (TIS) has been prepared to accompany an Environmental Impact Statement (EIS) for a proposed small scale sand extraction project at Anna Bay NSW.

1.1 The Project Proposal

Tattersall Lander Pty Ltd on behalf of Hay Enterprises (NSW) Pty Ltd is seeking to develop a small scale sand mine with associated machinery shed, access roads and a caretakers residence at No. 4226 Nelson Bay Road Anna Bay NSW.

The Project is a proposed mine to access and remove as required, sand material that is threatening a main 33kV AusGrid transmission line that serves the Nelson Bay area. The sand has accumulated and continues to accumulate under the transmission lines through wind action. The proposal is 'designated' development, being an 'extractive industry' with a planned extraction rate of up to a maximum of 50,000 cubic metres per year and is within 500 metres of another extractive industry site operating during the last 5 years.

The operating life of the site is anticipated to be 30 years.

1.2 Scope of Work

These investigations have assessed the range of traffic and transport features of the subject site and its surrounds with specific reference to the requirements of the Guide to Traffic Generating Developments (Version 2.2, RTA October 2002) (Herein after referred to as the Guide) The work is required to accompany the Environmental Impact Statement supporting the Development proposal for the subject site and development. Specific work tasks have included:

1. INCEPTION – Project briefing, review of Secretary's Environmental Assessment Requirements (SEAR's)
2. SITE INVESTIGATIONS – Consideration of the existing form and features of the surrounding road system.
3. TRAFFIC COUNTS – Turning counts for one weekday peak period at the intersection of Nelson Bay Road with Port Stephens Drive, conducted on Tuesday 6th December 2017 prior to school holidays affecting traffic flows, to represent regular weekday activity which is more relevant to this operation.
4. An automatic counter was also placed on Nelson Bay Road for 7 days in the vicinity of the subject site, from Tuesday 6th December 2017 to Tuesday 13th December 2017.
5. DESIGN REVIEW – Site access assessment and review of proposed production capacity issues and traffic movements – review road connections as suitable for site access requirements, from a technical capacity, movement and also road safety perspective.
6. ASSESSMENT – Traffic Impact Assessment in accordance with the Guide to Traffic Generating Development (RTA 2002)
7. TIS REPORT – Prepare a Traffic Impact Statement (TIS) incorporating the findings from the above assessments, suitable for lodging with the road authorities for approval and addressing the matters raised in the traffic and transport elements of EAR 1172:
 - a. predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;
 - b. assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads;
 - c. description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development;
 - d. evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and
 - e. description of access roads, specifically in relation to nearby Crown roads and fire trails;

The TIS report is set out as follows:

- Chapter 2 describes the existing situation
- Chapter 3 details the traffic and transport aspects of the subject site and development proposal
- Chapter 4 presents the traffic impact assessment of the proposal
- Chapter 5 summarises the conclusions and recommendations from the investigations.

2 Project Background

2.1 Site Description and Local Context

The project site is located within the Port Stephens Shire Council Local Government area at Lot 591 DP 1191380 4226 Nelson Bay Road Anna Bay NSW.

The local environment surrounding the project includes a range of different land uses and could be described as semi-rural in character. There is a mixture of land uses along Nelson Bay Road, which provides the only road access to the subject site. These include a number of residential properties, a church, other extractive industry and earth moving businesses, a petrol station and some smaller agricultural land holdings. The site is currently zoned RU2 under the Port Stephens Council LEP 2013.

The site is bounded by Nelson Bay Road to the north, and the sand dunes of Stockton Bight to the south.

There is an electricity easement located east-west across the property and it is the migration and encroachment of sand from the Stockton Bight to the south that is the subject of this project proposal. To the east of the site is the Baylife Church.



Photo 1 – Electricity lines within easement across subject site, looking east. Showing sand to the right

The site location and local road network are shown in Figures 1 and 2 below and overleaf.

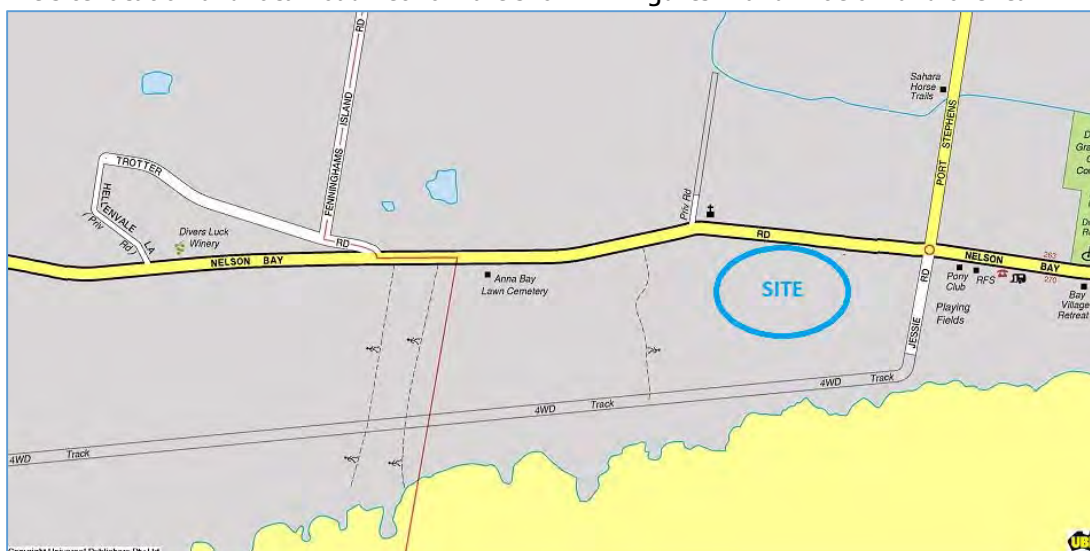


Figure 1 – Local Road Network

Source: UBD Australian City Streets Version 5.0

Note: The extent of sand dunes shown is for illustrative purposes only and is not accurate



Figure 2 – Site Concept Plan – Area designated SP2 is Nelson Bay Road
Source: Tattersall Lander Pty Ltd 2017

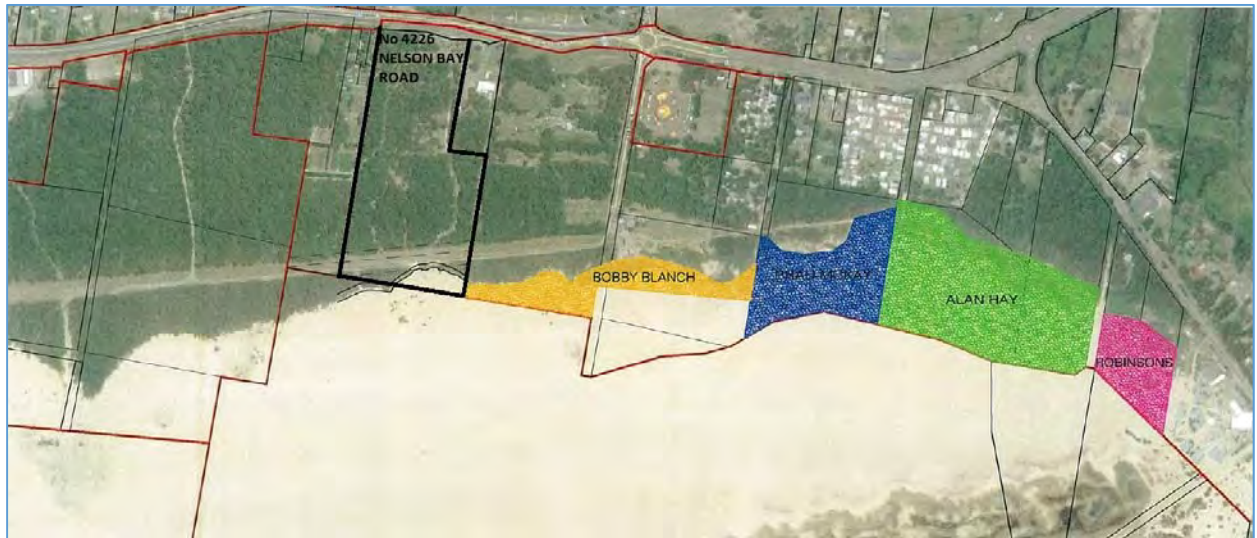


Figure 3 – Adjoining Sand Extraction Operations

Source: Tattersall Lander Pty Ltd 2017

2.2 Site Access Road Network

Nelson Bay Road

The most significant road in the network that serves the subject site is Nelson Bay Road. It is a classified main road, designated as the B63 route in the NSW main road network. It is an arterial road with the section in the immediate vicinity of the subject site upgraded to four lane dual carriageway standard in May 2015, applying a rural design standard. 100% of traffic that will access the site will use Nelson Bay Road.



Photo 2 –Nelson Bay Road looking east in the vicinity of the subject site.



Photo 3 – Nelson Bay Road looking east from Nelson Bay Road / Port Stephens Drive Roundabout



Photo 4 – Nelson Bay Road looking west from Nelson Bay Road / Port Stephens Drive Roundabout.

There is a central median in place preventing right turns along the section of the road from Bobs Farm to Anna Bay, except where specific turn facilities are provided. There are a number of right turn and U-turn bays for example at Trotter Road and Cromarty Lane, with every second bay suitable for large vehicles.



Photo 5 – Trotter Road Seagull intersection and U-turn facility on Nelson Bay Road (looking East)



Photo 6 – Seagull intersection allowing right turn movements at Nelson Bay Road / Trotter Road (looking east)



Photo 7 – U-turn bay at Nelson Bay Road / Trotter Road

Port Stephens Road / Nelson Bay Road Roundabout

With right runs prohibited by a central median, traffic approaching the subject site from the west has to perform a U-turn at the roundabout controlled intersection of Nelson Bay Road with Port Stephens Drive. This is a four leg intersection with the southern leg being Jessie Road. (See overleaf.)



Photo 8 – Western approach to Nelson Bay Road / Port Stephens Drive Roundabout, looking east



Photo 9 – Eastbound circulating lane through Nelson Bay Road / Port Stephens Drive Roundabout



Photo 10 –Port Stephens Drive looking north from Nelson Bay Road Roundabout

Jessie Road

Jessie Road is a local road connecting to the Nelson Bay Road / Port Stephens Drive roundabout as the southern of four legs. It is an unsealed road providing access to a number of properties, including the Nelson Bay Pony Club, a carpark on the south eastern corner of the roundabout and an earthmoving business. It also provides access to the easement which carries electricity lines across the subject site. It has unofficial signposts noting the road as a 'No Through Road', with no access to the beach or sand dunes.



Photo 11 – Jessie Road looking north toward the Nelson Bay Road / Port Stephens Drive Roundabout



Photo 12 – Jessie Road looking south from the Nelson Bay Road / Port Stephens Drive Roundabout



Photo 13 – Jessie Road looking south



Photo 14 – Easement looking west from Jessie Road toward subject site.

2.3 Traffic Surveys and Site Observations

1. Traffic Surveys

Monitoring of traffic movements was conducted for one week day peak period at the intersection of Nelson Bay Road with Port Stephens Drive. The count was conducted on Tuesday 6th December 2017, prior to school holidays affecting traffic flows, to represent regular weekday activity which is more relevant to this operation.

An automatic counter was also placed on Nelson Bay Road for 7 days in the vicinity of the subject site, from Tuesday 6th December 2017 to Tuesday 13th December 2017. Confirming directional volumes by hour, vehicle and speed classifications. The survey data is included in **Appendix A – Traffic Survey Data**.

2. General Site Observations

The most significant observations from a traffic movement, efficiency and road safety perspective that were observed from the data monitoring and subsequent site observations were:

1. Road network traffic flows appear to be well within technical capacity limits of the road system;
2. Heavy vehicles were a small percentage within the traffic stream on Nelson Bay Road through Anna Bay; flows were around 6.5 to 7% of recorded total flows.
3. Bus movements were observed along Nelson Bay Road
4. Turning movements at the Nelson Bay Road /Port Stephens Drive roundabout, including heavy vehicles, operate well.

5. Nelson Bay Road carries a combined (two-way) volume of around 20,000 vehicles (1994/5) on weekdays.
6. The AM peak weekday westbound traffic flow was recorded at around 7 AM and 925 vph in two lanes.
7. The corresponding PM westbound peak was recorded around 4 PM and 740 vph in two lanes.
8. The 85th percentile speed was recorded as 82.5 kph (Noting the posted speed limit is 80 kph)
9. There are a number of U-turn facilities provided along Nelson Bay Road, alternating between small vehicle facilities, and U-turn bays suitable for larger vehicles (buses and trucks)
10. Observations at the Nelson Bay Road / Port Stephens Road roundabout indicate it currently operates at good levels of service at peak times.. (Austroads 2009) (See also Section 4 of this report.)

The above observations have been taken into account when considering the proposed new land use.

2.4 Cycling Facilities

The Review of Environmental Factors that accompanied the planning approval for the upgrade of Nelson Bay Road from Bobs Farm to Anna Bay, included noting provision of cycling facilities as part of that project. The treatment was essentially to provide cycling facilities in the form of 2 metre shoulders along the route in each direction.

Given the rural character of the area there are no specific pedestrian facilities in the vicinity.

2.5 Public Transport Services

The locality of Anna Bay is served by bus public transport through Port Stephens Coaches. While not of significant relevance to the project operations, there are bus services along Nelson Bay Road passing the site, travelling to and from the Nelson Bay / Salamander Bay area, to Newcastle Airport, and on the Newcastle City. Consequently the site is quite well served for the commuter needs of any employees choosing to travel by other than car. There are three services passing the site (Routes 130, 131, 135) with a fourth (Route 143) travelling through the nearby Nelson Bay Road /. Port Stephens Drive roundabout. A map illustrating the services is included in **Appendix B Port Stephens Public Transport Network**.

2.6 Authority Liaison

Liaison has been undertaken by the project planners with the NSW Department of Planning and Environment with respect to the Secretary's Environmental Assessment Requirements (SEARs) for the preparation of an Environmental Impact Statement for the subject site. In preparing the SEARs NSW Roads and Maritime Services were consulted as part of this process and the following matters were noted as assessment requirements from a traffic and transport perspective:

The Department of Planning & Environment has issued Secretary's Environmental Assessment Requirements (SEAR's) under Section 78A(8A) of the *Environmental Planning and Assessment Act 1979* Schedule 2 of the *Environmental Planning and Assessment Regulation 2000*

Traffic and Transport is noted as a general issue that the EIS must address including the following matters:

- a. predictions of the road traffic generated by the construction and operation of the development, including a description of the types of vehicles likely to be used for transportation of quarry products;
- b. assessment of potential traffic impacts on the capacity, condition, safety and efficiency of the local and State road networks, detailing the nature of the traffic generated, transport routes, traffic volumes and potential impacts on local and regional roads;
- c. description of the measures that would be implemented to maintain and/or improve the capacity, efficiency and safety of the road network (particularly the proposed transport routes) over the life of the development;
- d. evidence of any consultation with relevant roads authorities, regarding the establishment of agreed contributions towards road upgrades or maintenance; and
- e. description of access roads, specifically in relation to nearby Crown roads and fire trails;

The above matters raised in the project SEARs have been considered in preparing this Traffic Impact Statement. With respect to road authority liaison this is expected to occur during the review phase of the project.

3 Proposed Development

3.1 Project Description Plan

The concept plan for the project showing site boundary, internal access road to the sand materials and site access into and out of the site from Nelson Bay Road is illustrated in **Appendix C – Proposed Sand Mine DA Plans**. The Project proposes to extract windblown sand and provide ancillary development incorporating a caretaker's residence and machinery shed. The proposed development has a planned sand extraction rate of up to a maximum of 50,000 cubic metres per year and for a maximum lifetime of 30 years. The proposed development site is within 500 metres of another extractive industry site operating during the last 5 years and is prescribed as designated development.

3.2 Assumed Project Construction Details

It is understood the total period for the construction of site amenities, upgrade of on-site haul road, and upgrade of the access intersection, etc. will be in the order of 1 to 2 months for work within the site. It has been assumed also that any work required for any access would be able to be completed within this same 1 to 2 month period.

The work would include some site clearing, construction of site amenities, upgrade of on-site haul road, and upgrade of the access intersection etc. It is expected that the construction time work day would be a typical industrial work day of 7am to 6pm Monday to Friday, and 8am to 1pm Saturday. No Sunday or public holiday work is planned. A typical inventory of equipment to be used for this type of construction phase, would be truck and dog haulage, excavator, concrete truck, rigid vehicle bringing shed materials.

3.3 Traffic Generation

In relation to expected truck movements for the project it has been assumed there will be a maximum of 40 two way movements per day. (i.e. 40 movements in and 40 movement out of the site.) This equates to advice on planned truck payloads of 1400 tonnes per day, based on the proposed use of a 35 tonne (~ 22 cubic metre) truck and dog combination. This equates to 55 full days of activity over a year.

It may be the demands are spread over more days, but this represents the assumed (planned) maximum movements that could occur on any one day.

With the turning volumes assumed accessing the site at around 40 truck movements per day plus some light traffic, over an 11 hour operating day (7am to 6pm Monday to Friday, 8am to 1am Saturdays) this would be in the order of 5 movements into the site in any one hour assuming a uniform flow profile (4 trucks and 1 car). This compares with the peak westbound flow on Nelson Bay Road recorded in February 2018 at 925 vph, this represents only a 0.5% change in traffic volumes. Even doubling this flow would only represent around 1% of passing traffic flows. And so in terms of determining the appropriate site access treatment it will be the through traffic component that determines the type of treatment required.

A traffic flow of 925 vph falls within the Level of Service 'B' range (900 to 1400 vph), at just over the highest category Level of Service 'A' threshold of 900 vph. Even if a 3% per annum background growth figure is added to this base flow for 10 years, a NSW Roads and Maritime requirement in all traffic impact assessment work in NSW (i.e. 30% over the base flows) the resulting flow of around 1200 vph still falls within the LoS 'B' range for urban road peak hour flows.

The conclusion is that road capacity is not considered an issue for the project proposal.

3.4 Site Access

Access to the site will be at one point and left in left out only, and if any trucks need to travel east, there are several U-turn bays within a short distance to the west along Nelson Bay Road suitable for use by heavy vehicles. Trucks travelling to the site from the west can perform a U-turn at the Port Stephens Drive roundabout.

Given the very low traffic volumes forecasted as requiring access to the site it is proposed to modify the existing site access to conform to a Rural Basic Left (BAL) turn treatment as illustrated in **Figure 3-1 Proposed Site Access Treatment** overleaf. An evaluation of this treatment is provide in Section 4 of this report.

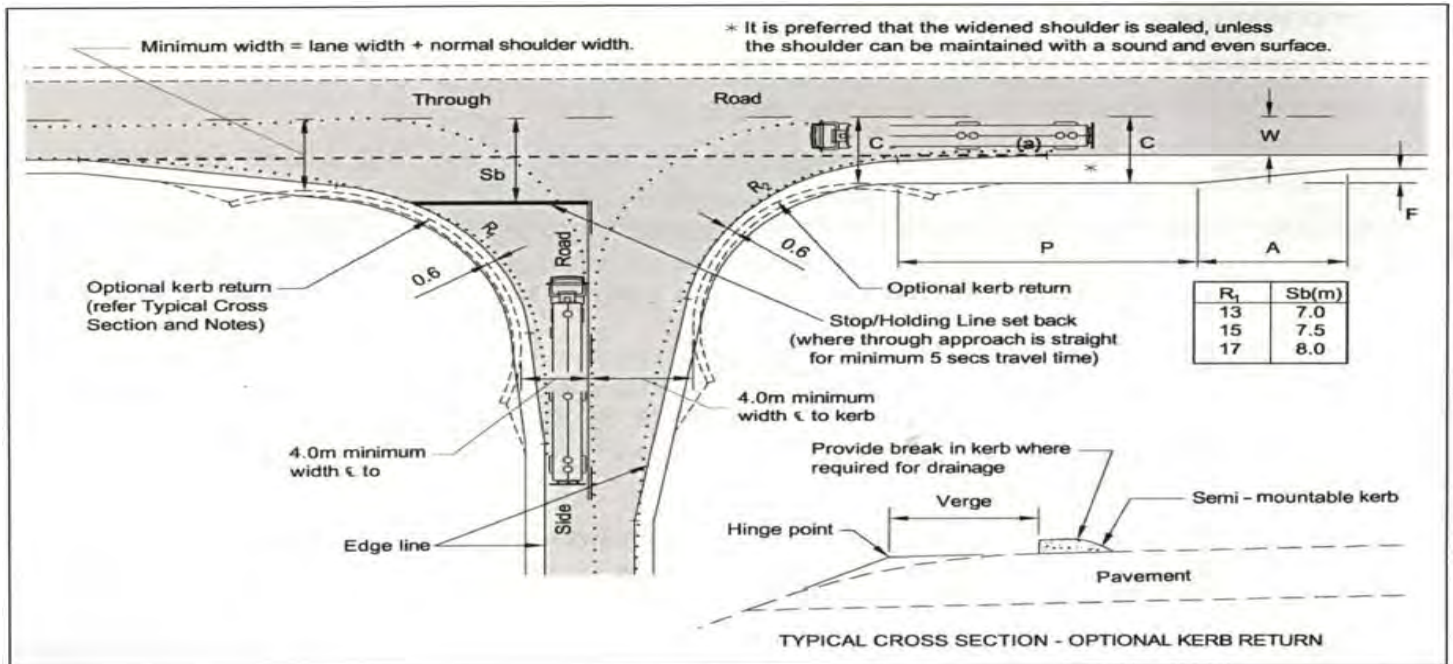


Figure 3-1 Proposed Site Access Treatment
Source: Austroads 2009

3.5 Traffic Assignment and Distribution

For the purposes of this assessment the following traffic assignment and distribution profiles have been considered. These have been based on what is considered to be a realistic flow profile for the operation.

1. 75% approach from west, departure to west, and
2. 25% approach from east and return to east.

In addition to the above scenario the following 'worst case' scenarios have also been considered;

3. 100% approach from west, departure to west, and
4. 100% approach from east and return to east.

It is expected that these 'worst case' scenarios are almost certain to never occur. They are included here as representing the absolute 'worst case' loading of both U-turn movements from the west at the Port Stephens Drive roundabout (3), and U-turn movements at say the Trotter Road U-turn bay (4). And so the peak hour loading for each of these scenarios would be 5 movements only into and out of the site in the peak hour.

4 Traffic Impact Assessment

4.1 Forecast Traffic Flows and Road Capacity

With the peak westbound flow on Nelson Bay Road recorded in February 2018 at 925 vph, the forecast traffic generation from the subject site represents only around a 0.5% change in current traffic volumes. Even doubling this flow would only represent around 1% of passing traffic flows which is still a quite minor variance.

The capacity and level of service results presented are drawn from the urban flow conditions and Levels of Service definitions as presented in the Guide to Traffic Generating Developments ((NSW RTA October 2002). These are reproduced below as **Table 4.1 – Urban Road peak hour flows per direction**. It can be seen that the ultimate capacity for a two lane urban road is 2200 vph at the acceptable technical limit of flow conditions under urban conditions of Level of Service 'D'.

Table 4.1 - Urban Road peak hour flows per direction

Level of service	One Lane (vph)	Two Lanes (vph)
A	200	900
B	380	1400
C	600	1800
D	900	2200
E	1400	2800

Source: RTA Guide to Traffic Generating Developments, version 2.2 dated October 2002.

A traffic flow of 925 vph falls within the Level of Service 'B' range (900 to 1400 vph), at just over the threshold of 900 kph for the highest category Level of Service 'A'. Even if a conservatively high, 3% per annum background growth figure is added to this base flow for 10 years, a NSW Roads and Maritime Services (RMS) requirement in all traffic impact assessment work in NSW (i.e. 30% over the base flows) the resulting flow of around 1200 vph still falls within the LoS 'B' range for urban road peak hour flows. A more realistic 2% growth rate would only result in a westbound peak flow of around 1100 vph, still LoS 'B'.

The conclusion is that road capacity is not considered an issue for the project proposal.

4.2 Traffic Planning and Management Issues

Background Growth

NSW RMS has for some time considered it necessary to make allowance for 'background growth' along its road corridors. This is slated as being required to take account of additional traffic flows from unknown sources that add to the base traffic flows. A conservative RMS 30 (i.e. 3% per annum) growth rate has been applied in this analysis.

Construction Traffic Management

As with operational traffic, construction traffic will utilise the Nelson Bay Road / Port Stephens Drive roundabout access the site from main road network. The proposed construction program will not require mobilisation of a major construction workforce. Rather the work required is anticipated will be completed over a 1 to 2 month period. Construction activities for the Project are planned to be undertaken between the hours of 7am to 6pm Monday to Friday, 8am to 1pm Saturday, with no Sunday or public holiday operations.

As such, significant construction traffic impacts are not expected as a result of the project.

4.3 Intersection Performance

The significant intersection of interest to the evaluation of the project proposal is the roundabout controlled junction of Nelson Bay Road and Port Stephens Drive.

When assessing intersection performance it is firstly useful to consider the Austroads threshold levels for intersection capacity under uninterrupted flow conditions. **Table 4.2 – Intersection Volumes Below which**

Scenarios 3 and 7 have tested all U-turns to return westbound to the subject site as being heavy vehicles. Scenarios 4 and 8 have added to 3 and 7 respectively 100% of Jessie Road flows as being heavy vehicles.

In all cases the forecast Level of Service on the Port Stephens Drive and Nelson Bay road approaches are at Level of Service 'A', and Jessie Road at LoS 'B' only for the AM Scenario 4 assumption of 100% of Jessie Road flows being heavy vehicles. Figure 4-2 SIDRA Intersection Level of Service Illustrates an overall summary of intersection performance.

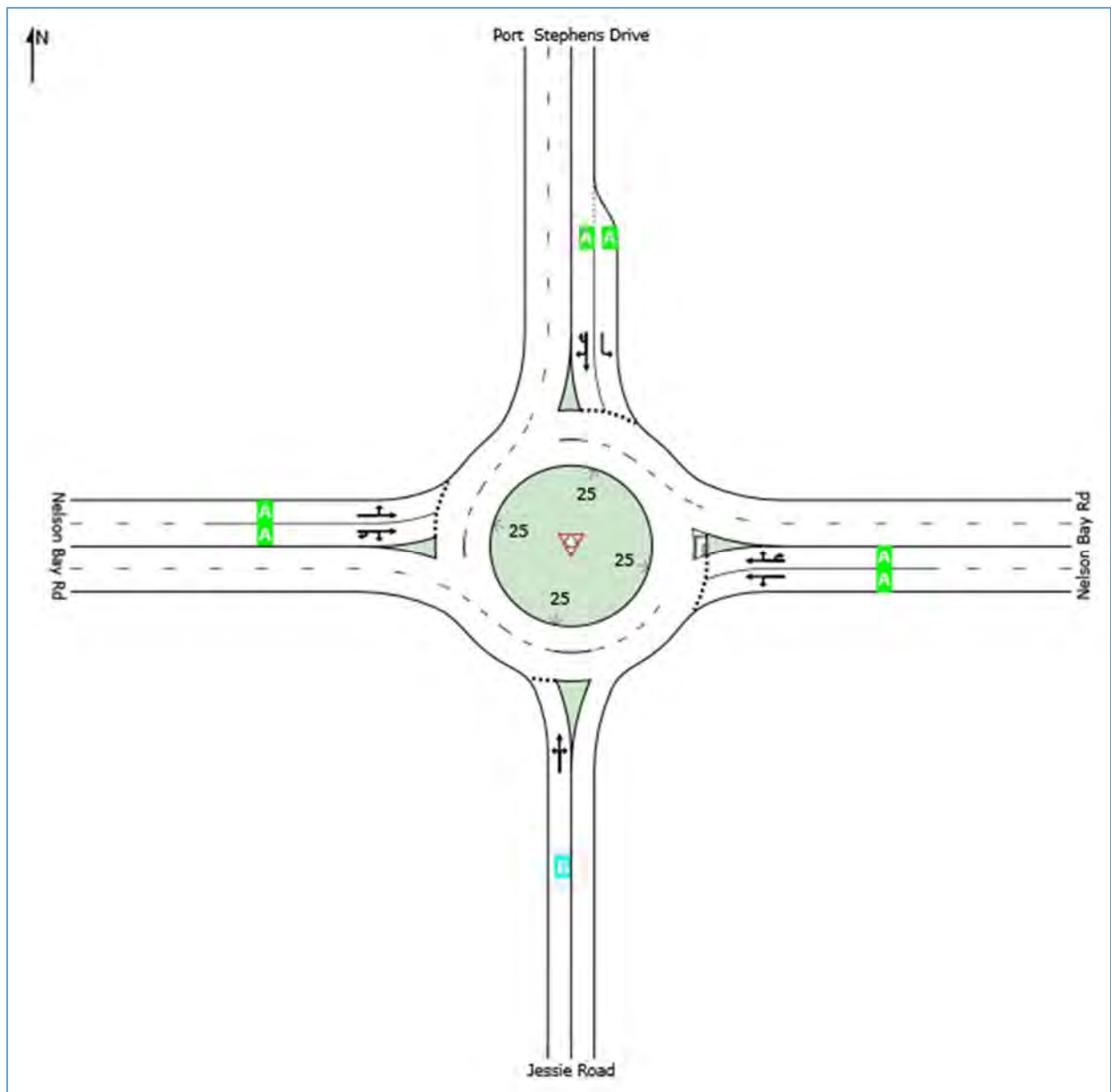


Figure 4-2 SIDRA Intersection Level of Service

Nelson Bay Rd & Port Stephens Dr AM Existing + RMS 30 + 100% Site U-TURNS 100% JESSIE RD TRUCKS

	South	East	North	West	Intersection
LOS	B	A	A	A	A

Source: SIDRA INTERSECTION 7.0 | Copyright © 2000-2017 Akcelik and Associates Pty Ltd | sidrasolutions.com

Organisation: MARK WAUGH PTY LTD (BTF) | Processed: Monday, March 5, 2018 12:33:44 PM

Project: C:\Users\mark.waugh\Documents\WORK\PROJECTS ACTIVE\ACTIVE\BTF2018239 Anna Bay TIS\SIDRA\Nelson Bay Rd Anna Bay Sand Extraction TIS.sip7

The conclusion from this analysis is that there will be no discernible change in traffic performance at this roundabout as a result of the forecast additional traffic from the subject site.

For the alternative 100% traffic flow from the east and returning to the east (which is very unlikely to occur in practice) the capacity of the U-turn facilities available is more than capable of catering for such flow levels the flows are as small as to not warrant specific intersection analysis.

By way of comparison, the Baylife Church site next door to the subject site is likely to generate higher traffic flows using a BAL access treatment. For example a congregation or gathering of say 50 people and a car occupancy of say 2.5 would generate 20 movements in and 20 movement out of that site.

The overall conclusion is that there will be no discernible traffic impacts from the operations of the project proposal. (Note: A full version of the electronic SIDRA Intersection Modelling file can be supplied if required.)

4.5 Recommended Site Access Layout

The Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (Austroads 2009) provides guidance on the warrants for various auxiliary lane treatments at intersections. **Figure 4-3 Warrant for turn treatments on major roads at unsignalised intersections** below illustrates the principles for a design speed of less than 100 kph. The posted speed limit on Nelson Bay Road is 80kph. The warrant relates turn treatments to a combination of major road traffic volume and turning volumes.

For the forecast traffic flows of only around 5 vehicle movements in the peak hour at the site access intersection a **BA**sic Left turn treatment (BAL) is considered an appropriate turn treatment according to Austroads. This is the case even if it is assumed that the lane flow proportion in the near (left lane passing the site access is equivalent to the through and turn volumes heading west from the Roundabout at Port Stephens Drive. (I.e. around two thirds of the total westbound flow.) Given the two lane approach on Nelson Bay Road to the roundabout the median (right) lane is likely to cater for a higher proportion of the total flow.

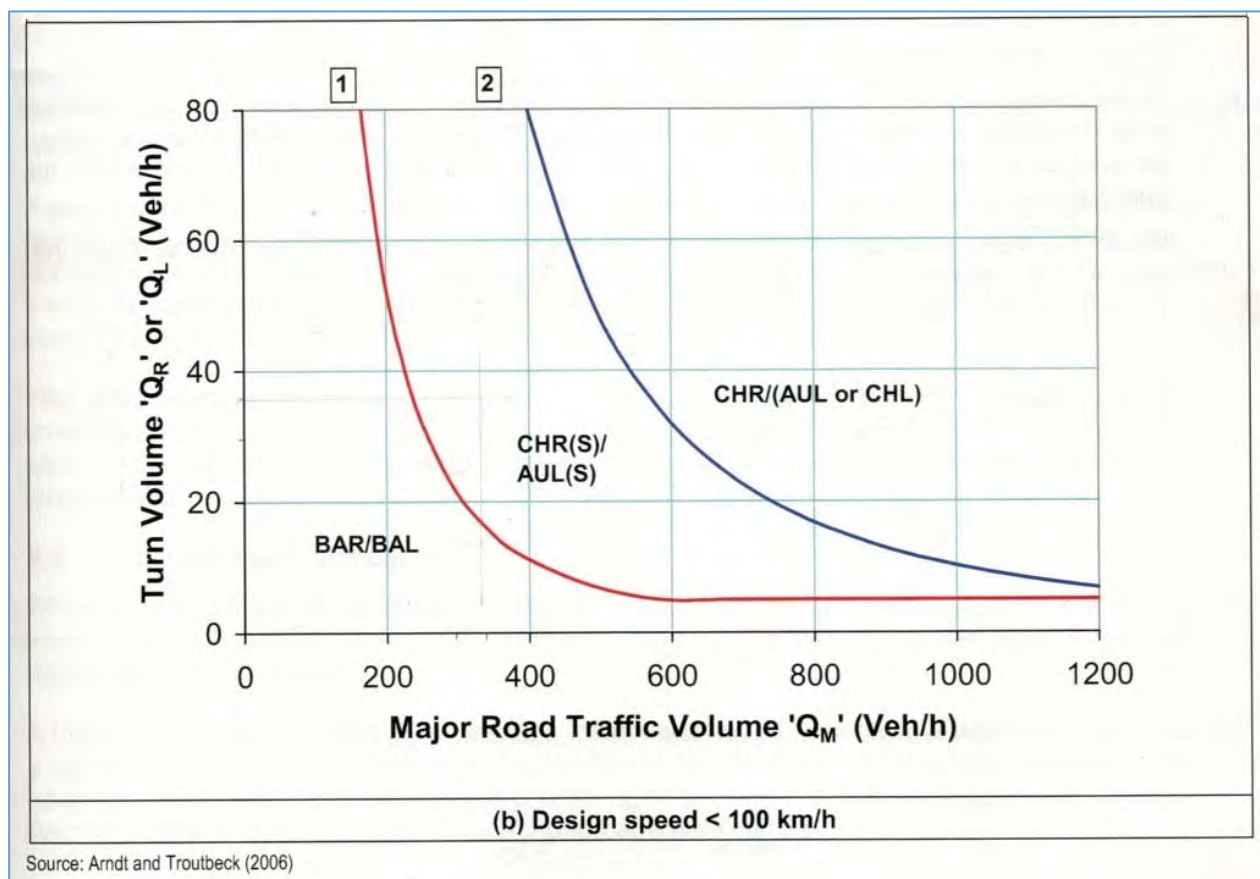
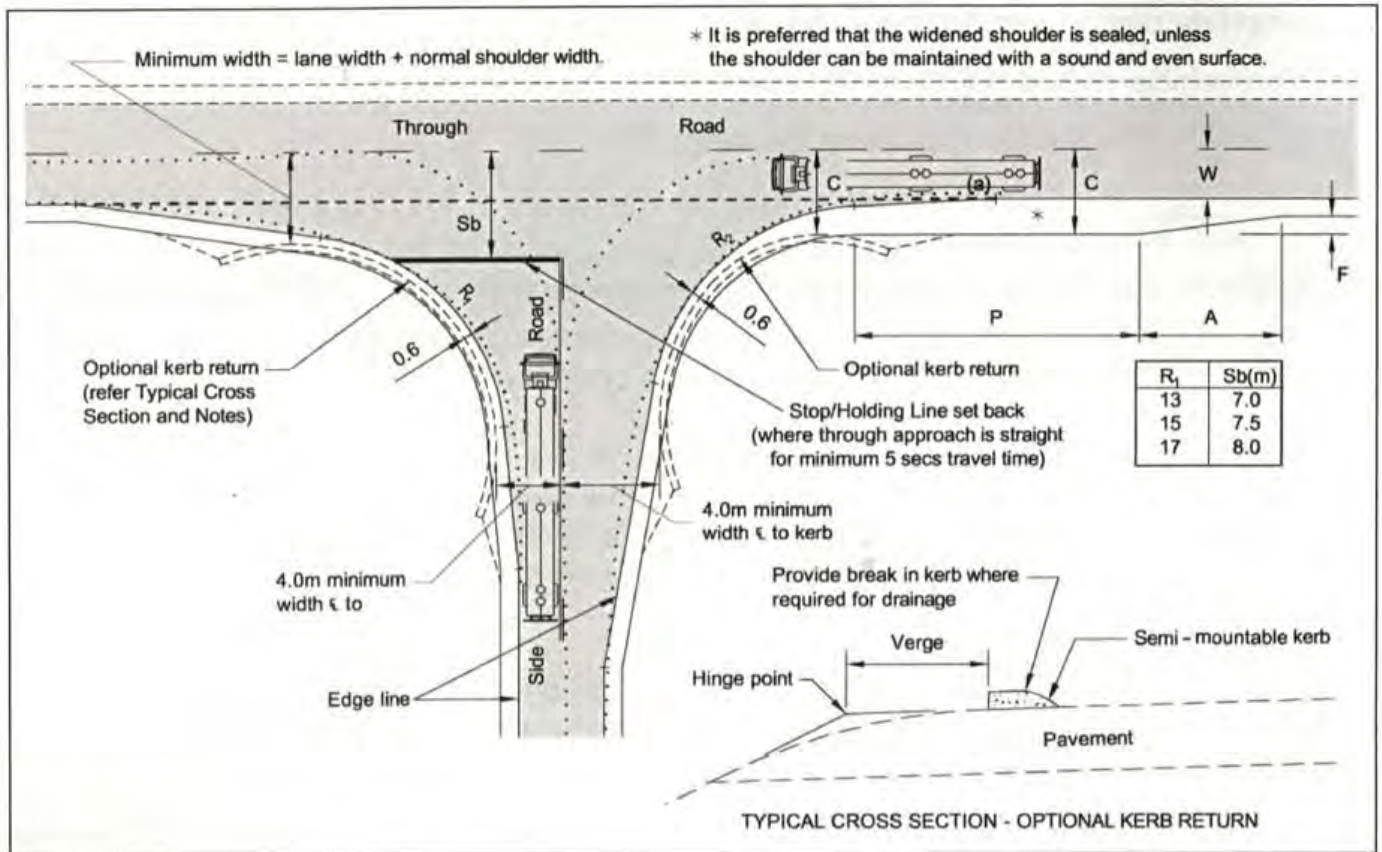


Figure 4-3 Warrant for turn treatments on major roads at unsignalised intersections
(Warrant for turn treatments less than 100kph)
Source: Austroads 2009

An illustration of the recommended Austroads Rural **BA**sic Left turn treatment (BAL) highlighting critical geometry is reproduced in Figure 4-4 **BA**sic Left (BAR) turn treatment on a two-lane rural road overleaf.



Notes:

1. R₁ and R₂ are determined by the swept path of the design vehicle.

2. The dimensions of the treatment are defined thus:

W = Nominal through lane width (m) (including widening for curves).

C = On straights – 6.0 m minimum.

On curves – 6.0 m plus curve widening (based on widening for the design turning vehicle plus widening for the design through vehicle).

$$A = \frac{0.5VF}{3.6}$$

V = Design speed of major road approach (km/h).

F = Formation/carriageway widening (m).

P = Minimum length of parallel widened shoulder (Table 8.1).

Figure 4-4 Basic Left (BAR) turn treatment on a two-lane rural road

Source: Reproduced from AustRoads 2009

5 Summary and Conclusions

5.1 Summary

Tattersall Lander Pty Ltd on behalf of Hay Enterprises (NSW) Pty Ltd is seeking to develop a small scale sand mine with associated machinery shed, access roads and a caretakers residence at No. 4226 Nelson Bay Road Anna Bay NSW.

The Project is a proposed mine to access and remove as required, sand material that is threatening a main 33kV AusGrid transmission line that serves the Nelson Bay area. The sand has accumulated and continues to accumulate under the transmission lines through wind action. The proposal is 'designated' development, being an 'extractive industry' with a planned extraction rate of up to a maximum of 50,000 cubic metres per year and is within 500 metres of another extractive industry site operating during the last 5 years.

The work would include some site clearing, construction of site amenities, upgrade of on-site haul road, and upgrade of the access intersection etc. The operating life of the site is anticipated to be 30 years.

Existing Conditions

- a. The subject site is located west of the roundabout controlled intersection of Nelson Bay Road and Port Stephens Drive at Anna Bay NSW.
- b. Existing flow conditions on the adjacent road system providing access to the site are very good, and well within the technical and functional capacity limits of local roads.
- c. Surveys of intersection flows indicate that the key roundabout at Nelson Bay Road / Port Stephens Drive operates at a very good Level of Service 'A'.

Proposed Development

- d. It is expected that the construction time work day would be a typical industrial work day of 7 am to 6pm Monday to Friday, and 8am to 1pm Saturday. No Sunday or public holiday work is planned.
- e. It is understood the total construction period for the project will be in the order of 1 to 2 months for work within the site. It has been assumed also that any work required for any access would be able to be completed within this same 1 to 2 month period.
- f. A typical inventory of equipment to be used for this type of construction phase, would be truck and dog haulage, excavator, concrete truck, rigid vehicle bringing shed materials.
- g. Expected truck movements for the project have been assumed as a maximum of 40 two way movements per day. (i.e. 40 movements in and 40 movement out of the site.) This equates to advice on planned truck payloads of 1400 tonnes per day, based on the proposed use of a 35 tonne (~ 22 cubic metre) truck and dog combination. This equates to 55 full days of activity over a year.
- h. It may be the demands are spread over more days, but this analysis assumption represents the assumed (planned) maximum movements that could occur on any one day.
- i. Expected traffic volumes in the peak hour based on a uniform flow profile over the operating day would be in the order of 5 movements into the site in any one hour assuming a uniform flow profile. With a peak westbound flow on Nelson Bay Road recorded in February 2018 at 925 vph, this represents only a 0.5% change in traffic volumes.
- j. A traffic flow of 925 vph falls within the Level of Service 'B' range (900 to 1400 vph), at just over the highest category Level of Service 'A' threshold of 900 vph.
- k. Applying a conservative 3% p.a. background growth rate to the 2018 flow for 10 years the resulting flow of around 1200 vph still falls within the LoS 'B' range for urban road peak hour flows.
- l. SIDRA Intersection Modelling has been conducted on the Nelson Bay Road / Port Stephens Drive roundabout for a number of conservative scenarios with all result existing an overall Level of Service 'A' during peak periods.

Access Future Performance

- m. A BAsic Left turn treatment (BAL) is considered an appropriate turn treatment according to Austroads

5.2 Conclusion

The conclusion drawn from this assessment is that both road and intersection capacity are not considered issues for the project. Subject to the assessment and recommendations contained herein it is recommended that the project proposal be approved on traffic and transport considerations.

Appendix A. Traffic Survey Data

TRANS TRAFFIC SURVEY

 trafficsurvey.com.au

T. 1300 82 88 82 - F. 1300 83 88 83 - E. traffic@trafficsurvey.com.au - W. www.trafficsurvey.com.au

AUTOMATIC COUNT SUMMARY

Street Name :	Nelson Bay Rd	Location :	West of Port Stephens Drive
Suburb :	Anna Bay	Start Date :	00:00 Tue 06-February-2018
Metrocount ID	Y624M6HR	Finish Date :	00:00 Tue 13-February-2018
Site ID Number :	640	Speed Zone :	90 km/h
Prepared By :	Vo Son Binh	Email:	binh@trafficsurvey.com.au

GPS information		Direction of Travel		
		Combined	Westbound	Eastbound
Lat	32° 46' 7.74 North			
Long	152° 3' 51.08 East			
Traffic Volume : (Vehicles/Day)	Weekdays Average	19,945	9,706	10,239
	7 Day Average	19,172	9,483	9,689
Weekday AM	07:00	1463	925	658
Peak hour start PM	16:00	1718	740	1054
Speeds : (Km/Hr)	85th Percentile	82.5	84.9	80.1
	Average	74.7	76.0	73.3
Classification % :	Light Vehicles up to 5.5m	94.0%	94.1%	94.0%

Location

GPS Information [Load Google Map \(internet required\)](#)

(Latitude, Longitude) -32.768816, 152.064189



[Speed Data](#)

[Speed Graph](#)

[Speed Bin](#)

[Volume Data](#)

[Volume Graph](#)

[Classification](#)



QUALITY ASSURED COMPANY BY ISO 9001:2015

OH&S SYSTEM CERTIFIED TO ISO 4801:2001

ENVIRONMENT MANAGEMENT SYSTEM CERTIFIED TO ISO14001:2015



Site Nelson Bay Rd

Direction Combined

[Back to Site Summary Page](#)

Day Date	Monday 12-02-18	Tuesday 06-02-18	Wednesday 07-02-18	Thursday 08-02-18	Friday 09-02-18	Saturday 10-02-18	Sunday 11-02-18	7 days		Weekday		Weekend	
								Total	Average	Total	Average	Total	Average
AM Peak	07:00	07:00	07:00	07:00	08:00	11:00	11:00	N/A	11:00	N/A	07:00	N/A	11:00
PM Peak	16:00	16:00	16:00	16:00	15:00	12:00	12:00	N/A	16:00	N/A	16:00	N/A	12:00
00:00	49	55	70	69	82	105	113	543	78	325	65	218	109
01:00	35	35	32	37	34	75	78	326	47	173	35	153	77
02:00	36	28	37	45	35	61	49	291	42	181	36	110	55
03:00	80	54	61	62	69	50	47	423	60	326	65	97	49
04:00	187	177	187	204	197	111	87	1150	164	952	190	198	99
05:00	580	571	594	570	554	260	148	3277	468	2869	574	408	204
06:00	1104	1134	1185	1097	1046	451	344	6361	909	5566	1113	795	398
07:00	1528	1505	1483	1487	1314	833	520	8670	1239	7317	1463	1353	677
08:00	1349	1378	1353	1407	1413	1025	790	8715	1245	6900	1380	1815	908
09:00	1201	1208	1246	1313	1395	1224	1201	8788	1255	6363	1273	2425	1213
10:00	1130	1216	1201	1251	1332	1507	1538	9175	1311	6130	1226	3045	1523
11:00	1192	1190	1158	1205	1342	1525	1664	9276	1325	6087	1217	3189	1595
12:00	1143	1143	1169	1196	1465	1543	1604	9263	1323	6116	1223	3147	1574
13:00	1204	1216	1163	1266	1630	1329	1604	9412	1345	6479	1296	2933	1467
14:00	1297	1377	1340	1416	1765	1287	1574	10056	1437	7195	1439	2861	1431
15:00	1511	1604	1569	1612	1837	1269	1503	10905	1558	8133	1627	2772	1386
16:00	1671	1653	1747	1698	1821	1282	1422	11294	1613	8590	1718	2704	1352
17:00	1484	1557	1515	1569	1619	1076	1143	9963	1423	7744	1549	2219	1110
18:00	821	848	863	924	1152	675	704	5987	855	4608	922	1379	690
19:00	400	435	468	552	694	443	462	3454	493	2549	510	905	453
20:00	323	365	375	437	552	344	325	2721	389	2052	410	669	335
21:00	226	271	250	330	485	262	239	2063	295	1562	312	501	251
22:00	134	160	175	207	295	231	133	1335	191	971	194	364	182
23:00	78	97	105	106	171	135	52	744	106	557	111	187	94
Total	18763	19277	19346	20060	22299	17103	17344	134192	19171	99745	19948	34447	17232
% Heavy	6.87%	6.77%	6.97%	6.61%	6.50%	3.88%	3.72%	5.98%		6.73%		3.80%	



Site Nelson Bay Rd

Direction

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Day Date	Monday 12-02-18	Tuesday 06-02-18	Wednesday 07-02-18	Thursday 08-02-18	Friday 09-02-18	Saturday 10-02-18	Sunday 11-02-18	7 days		Weekday		Weekend	
								Total	Average	Total	Average	Total	Average
AM Peak	08:00	08:00	08:00	08:00	11:00	11:00	11:00	N/A	11:00	N/A	08:00	N/A	11:00
PM Peak	16:00	16:00	16:00	16:00	16:00	12:00	12:00	N/A	16:00	N/A	16:00	N/A	12:00
00:00	31	30	39	45	52	65	63	325	46	197	39	128	64
01:00	19	21	14	19	19	41	39	172	25	92	18	80	40
02:00	18	12	19	22	19	28	24	142	20	90	18	52	26
03:00	16	12	17	25	26	21	21	138	20	96	19	42	21
04:00	34	45	37	47	49	34	37	283	40	212	42	71	36
05:00	121	115	147	132	151	87	78	831	119	666	133	165	83
06:00	358	349	384	365	331	243	188	2218	317	1787	357	431	216
07:00	544	537	547	548	514	494	328	3512	502	2690	538	822	411
08:00	633	664	648	687	659	574	451	4316	617	3291	658	1025	513
09:00	595	645	587	630	645	586	492	4180	597	3102	620	1078	539
10:00	525	599	578	613	626	793	659	4393	628	2941	588	1452	726
11:00	621	599	600	622	726	839	750	4757	680	3168	634	1589	795
12:00	616	568	600	590	802	843	819	4838	691	3176	635	1662	831
13:00	609	621	569	621	959	688	681	4748	678	3379	676	1369	685
14:00	656	673	676	704	1002	698	625	5034	719	3711	742	1323	662
15:00	805	847	833	866	1081	569	579	5580	797	4432	886	1148	574
16:00	1016	1054	1052	1044	1106	594	503	6369	910	5272	1054	1097	549
17:00	980	997	963	1035	1030	485	450	5940	849	5005	1001	935	468
18:00	557	549	573	616	761	382	353	3791	542	3056	611	735	368
19:00	237	254	280	325	501	248	225	2070	296	1597	319	473	237
20:00	167	194	201	254	371	183	158	1528	218	1187	237	341	171
21:00	134	174	147	193	337	123	121	1229	176	985	197	244	122
22:00	87	110	131	153	212	124	84	901	129	693	139	208	104
23:00	53	66	74	76	122	86	33	510	73	391	78	119	60
Total	9432	9735	9716	10232	12101	8828	7761	67805	9689	51216	10239	16589	8301
% Heavy	6.85%	7.02%	7.20%	6.85%	6.51%	3.74%	3.11%	6.03%		6.87%		3.44%	



Site Nelson Bay Rd

Direction

[Back to Site Summary Page](#)

Day Date	Monday 12-02-18	Tuesday 06-02-18	Wednesday 07-02-18	Thursday 08-02-18	Friday 09-02-18	Saturday 10-02-18	Sunday 11-02-18	7 days		Weekday		Weekend	
								Total	Average	Total	Average	Total	Average
AM Peak	07:00	07:00	07:00	07:00	07:00	10:00	11:00	N/A	07:00	N/A	07:00	N/A	11:00
PM Peak	15:00	15:00	15:00	15:00	14:00	12:00	14:00	N/A	15:00	N/A	15:00	N/A	15:00
00:00	18	25	31	24	30	40	50	218	31	128	26	90	45
01:00	16	14	18	18	15	34	39	154	22	81	16	73	37
02:00	18	16	18	23	16	33	25	149	21	91	18	58	29
03:00	64	42	44	37	43	29	26	285	41	230	46	55	28
04:00	153	132	150	157	148	77	50	867	124	740	148	127	64
05:00	459	456	447	438	403	173	70	2446	349	2203	441	243	122
06:00	746	785	801	732	715	208	156	4143	592	3779	756	364	182
07:00	984	968	936	939	800	339	192	5158	737	4627	925	531	266
08:00	716	714	705	720	754	451	339	4399	628	3609	722	790	395
09:00	606	563	659	683	750	638	709	4608	658	3261	652	1347	674
10:00	605	617	623	638	706	714	879	4782	683	3189	638	1593	797
11:00	571	591	558	583	616	686	914	4519	646	2919	584	1600	800
12:00	527	575	569	606	663	700	785	4425	632	2940	588	1485	743
13:00	595	595	594	645	671	641	923	4664	666	3100	620	1564	782
14:00	641	704	664	712	763	589	949	5022	717	3484	697	1538	769
15:00	706	757	736	746	756	700	924	5325	761	3701	740	1624	812
16:00	655	599	695	654	715	688	919	4925	704	3318	664	1607	804
17:00	504	560	552	534	589	591	693	4023	575	2739	548	1284	642
18:00	264	299	290	308	391	293	351	2196	314	1552	310	644	322
19:00	163	181	188	227	193	195	237	1384	198	952	190	432	216
20:00	156	171	174	183	181	161	167	1193	170	865	173	328	164
21:00	92	97	103	137	148	139	118	834	119	577	115	257	129
22:00	47	50	44	54	83	107	49	434	62	278	56	156	78
23:00	25	31	31	30	49	49	19	234	33	166	33	68	34
Total	9331	9542	9630	9828	10198	8275	9583	66387	9483	48529	9706	17858	8934
% Heavy	6.89%	6.52%	6.74%	6.35%	6.48%	4.02%	4.22%	5.93%		6.59%		4.13%	

TRANS TRAFFIC SURVEY

TURNING MOVEMENT SURVEY

trafficsurvey.com.au



Intersection of Port Stephens Dr and Nelson Bay Rd, Nelson Bay

Date:	Tue 06-02-18
Weather:	Fine
Suburban:	Nelson Bay
Customer:	BTFF

North:	Port Stephens Dr
East:	Nelson Bay Rd
South:	Jessie Rd
West:	Nelson Bay Rd

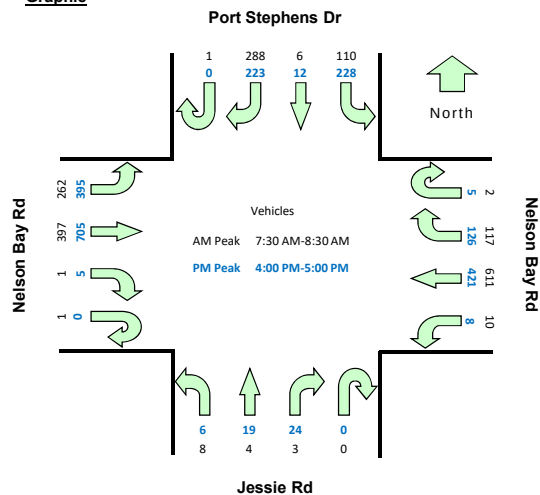
Survey Start	AM:	6:00	PM:	15:00
Vehicular Peakhour		Pedestrians Peakhour		
AM:	7:30 AM-8:30 AM	AM:	N/A	
PM:	4:00 PM-5:00 PM	PM:	N/A	

All Vehicles

Time		North Approach Port Stephens Dr				East Approach Nelson Bay Rd				South Approach Jessie Rd				West Approach Nelson Bay Rd				Hourly Total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L	Hour	Peak
6:00	6:15	0	56	2	7	1	8	139	1	0	1	0	3	1	2	27	10	1274	
6:15	6:30	0	66	0	11	2	17	123	2	0	0	1	1	0	2	31	25	1414	
6:30	6:45	0	66	1	10	1	14	146	3	0	0	0	0	2	1	47	42	1579	
6:45	7:00	0	61	1	11	0	34	159	0	0	0	0	1	0	0	68	67	1678	
7:00	7:15	0	91	2	25	1	16	173	1	0	0	0	2	0	1	52	34	1781	
7:15	7:30	0	102	1	15	2	24	189	1	0	0	0	2	0	1	71	38	1819	
7:30	7:45	0	71	1	20	2	25	163	1	0	1	0	1	0	0	94	53	1821	Peak
7:45	8:00	0	79	3	34	0	29	172	5	0	2	1	4	0	1	108	67	1776	
8:00	8:15	1	62	1	28	0	22	149	3	0	0	1	1	0	0	94	74	1636	
8:15	8:30	0	76	1	28	0	41	127	1	0	0	2	2	1	0	101	68	1579	
8:30	8:45	1	68	1	24	0	40	99	1	0	0	0	1	2	2	92	56	1528	
8:45	9:00	0	58	0	29	0	44	88	0	0	0	0	0	0	1	92	53	1585	
9:00	9:15	0	51	0	39	0	47	105	1	0	0	0	2	0	0	82	52	1607	
9:15	9:30	0	34	0	40	0	55	108	1	0	0	0	2	1	1	103	52		
9:30	9:45	0	55	1	45	0	40	113	1	0	2	0	1	0	1	109	76		
9:45	10:00	0	49	0	27	3	44	92	0	0	0	0	0	0	0	110	62		
15:00	15:15	0	81	1	50	5	50	125	0	0	1	1	0	0	0	125	78	2045	
15:15	15:30	1	69	1	40	5	41	120	0	0	0	1	0	1	1	140	79	2102	
15:30	15:45	0	80	2	59	4	35	134	0	0	3	1	1	0	0	119	81	2149	
15:45	16:00	2	53	7	44	2	43	117	5	0	7	7	4	0	4	132	83	2152	
16:00	16:15	0	71	8	53	1	25	107	4	0	6	5	2	0	1	177	114	2177	Peak
16:15	16:30	0	57	1	56	0	46	114	1	0	15	13	1	0	3	152	87	2102	
16:30	16:45	0	47	1	53	1	27	101	2	0	3	1	1	0	0	182	103	2084	
16:45	17:00	0	48	2	66	3	28	99	1	0	0	0	2	0	1	194	91	2031	
17:00	17:15	0	54	2	54	3	28	92	2	0	2	1	1	0	0	179	81	1939	
17:15	17:30	0	65	0	46	1	27	102	1	0	2	0	2	0	0	191	91	1741	
17:30	17:45	0	60	0	49	1	25	90	1	0	0	0	1	0	0	159	83	1498	
17:45	18:00	1	54	0	30	0	25	79	0	0	1	1	0	0	0	164	88	1263	
18:00	18:15	0	40	0	31	0	20	62	1	0	0	0	0	0	0	98	49	1025	
18:15	18:30	0	22	0	26	0	14	46	1	0	0	0	1	0	0	104	71		
18:30	18:45	0	20	0	22	1	15	47	0	0	1	2	1	0	0	78	47		
18:45	19:00	0	23	0	12	1	11	43	1	0	0	0	2	0	0	85	27		

Peak Time		North Approach Port Stephens Dr				East Approach Nelson Bay Rd				South Approach Jessie Rd				West Approach Nelson Bay Rd				Peak total	
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L		
7:30	8:30	1	288	6	110	2	117	611	10	0	3	4	8	1	1	397	262	1821	
16:00	17:00	0	223	12	228	5	126	421	8	0	24	19	6	0	5	705	395	2177	

Graphic



Light Vehicles

Time		North Approach Port Stephens Dr				East Approach Nelson Bay Rd				South Approach Jessie Rd				West Approach Nelson Bay Rd			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:00	6:15	0	52	2	4	1	7	134	1	0	1	0	3	0	2	27	10
6:15	6:30	0	59	0	8	2	17	121	2	0	0	0	1	0	1	28	22
6:30	6:45	0	65	1	8	1	12	145	3	0	0	0	0	2	0	43	39
6:45	7:00	0	58	1	8	0	32	155	0	0	0	0	0	0	0	63	63
7:00	7:15	0	88	2	16	1	14	169	1	0	0	0	0	0	1	45	29
7:15	7:30	0	96	1	12	1	22	184	1	0	0	0	2	0	0	63	33
7:30	7:45	0	67	1	17	2	23	158	1	0	0	0	1	0	0	85	49
7:45	8:00	0	75	3	32	0	27	167	5	0	2	1	3	0	1	103	61
8:00	8:15	1	58	1	27	0	21	146	3	0	0	1	1	0	0	79	65
8:15	8:30	0	70	1	25	0	38	122	1	0	0	2	2	1	0	89	59
8:30	8:45	1	63	1	22	0	39	94	1	0	0	0	1	2	1	85	52
8:45	9:00	0	53	0	27	0	44	81	0	0	0	0	0	0	0	81	47
9:00	9:15	0	50	0	36	0	45	97	1	0	0	0	1	0	0	77	48
9:15	9:30	0	30	0	36	0	51	102	1	0	0	0	1	1	0	99	48
9:30	9:45	0	48	1	44	0	38	106	1	0	0	0	1	0	0	106	67
9:45	10:00	0	46	0	24	3	42	89	0	0	0	0	0	0	0	101	53
15:00	15:15	0	76	1	50	5	50	112	0	0	1	1	0	0	0	120	69
15:15	15:30	1	65	1	40	5	40	115	0	0	0	1	0	1	1	135	71
15:30	15:45	0	72	2	57	4	35	128	0	0	3	1	0	0	0	117	78
15:45	16:00	2	52	6	44	2	42	112	5	0	6	4	4	0	2	127	82
16:00	16:15	0	67	8	53	1	23	98	4	0	5	5	2	0	0	175	110
16:15	16:30	0	54	1	56	0	43	112	1	0	14	10	1	0	1	151	85
16:30	16:45	0	47	1	52	1	26	100	1	0	3	1	1	0	0	182	103
16:45	17:00	0	48	2	64	3	25	92	1	0	0	0	2	0	1	190	87
17:00	17:15	0	50	2	53	3	26	89	2	0	2	1	1	0	0	178	79
17:15	17:30	0	61	0	46	1	26	99	1	0	2	0	2	0	0	189	89
17:30	17:45	0	60	0	48	1	24	89	1	0	0	0	1	0	0	157	80
17:45	18:00	1	53	0	30	0	25	76	0	0	1	1	0	0	0	161	84
18:00	18:15	0	40	0	31	0	20	60	1	0	0	0	0	0	0	95	48
18:15	18:30	0	21	0	26	0	14	46	1	0	0	0	1	0	0	103	67
18:30	18:45	0	19	0	22	1	14	47	0	0	1	2	1	0	0	77	46
18:45	19:00	0	21	0	12	1	11	43	1	0	0	0	2	0	0	84	26

Heavy Vehicles

Time		North Approach Port Stephens Dr				East Approach Nelson Bay Rd				South Approach Jessie Rd				West Approach Nelson Bay Rd			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:00	6:15	0	4	0	1	0	1	5	0	0	0	0	0	1	0	0	0
6:15	6:30	0	7	0	2	0	0	2	0	0	0	1	0	0	1	3	3
6:30	6:45	0	1	0	1	0	2	0	0	0	0	0	0	0	1	4	3
6:45	7:00	0	2	0	0	0	1	4	0	0	0	0	1	0	0	5	4
7:00	7:15	0	2	0	7	0	1	3	0	0	0	0	2	0	0	7	5
7:15	7:30	0	2	0	1	0	1	3	0	0	0	0	0	0	1	6	5
7:30	7:45	0	3	0	2	0	1	5	0	0	1	0	0	0	0	9	4
7:45	8:00	0	4	0	2	0	1	2	0	0	0	0	1	0	0	5	6
8:00	8:15	0	3	0	1	0	0	3	0	0	0	0	0	0	0	13	9
8:15	8:30	0	5	0	3	0	3	4	0	0	0	0	0	0	0	11	9
8:30	8:45	0	4	0	1	0	1	4	0	0	0	0	0	0	1	7	3
8:45	9:00	0	5	0	2	0	0	7	0	0	0	0	0	0	1	11	6
9:00	9:15	0	1	0	3	0	0	7	0	0	0	0	1	0	0	4	4
9:15	9:30	0	4	0	4	0	1	6	0	0	0	0	1	0	1	4	4
9:30	9:45	0	5	0	1	0	1	6	0	0	2	0	0	0	1	3	8
9:45	10:00	0	3	0	3	0	2	3	0	0	0	0	0	0	0	5	9
15:00	15:15	0	5	0	0	0	0	13	0	0	0	0	0	0	0	4	7
15:15	15:30	0	4	0	0	0	0	3	0	0	0	0	0	0	0	5	6
15:30	15:45	0	7	0	1	0	0	4	0	0	0	0	1	0	0	2	3
15:45	16:00	0	1	0	0	0	1	5	0	0	0	1	0	0	0	4	1
16:00	16:15	0	4	0	0	0	1	8	0	0	0	0	0	0	0	1	4
16:15	16:30	0	3	0	0	0	1	2	0	0	0	0	0	0	0	0	1
16:30	16:45	0	0	0	1	0	0	1	1	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	2	0	2	6	0	0	0	0	0	0	0	4	4
17:00	17:15	0	4	0	1	0	1	3	0	0	0	0	0	0	0	1	1
17:15	17:30	0	4	0	0	0	0	3	0	0	0	0	0	0	0	1	2
17:30	17:45	0	0	0	1	0	0	1	0	0	0	0	0	0	0	2	3
17:45	18:00	0	1	0	0	0	0	2	0	0	0	0	0	0	0	3	3
18:00	18:15	0	0	0	0	0	0	2	0	0	0	0	0	0	0	3	1
18:15	18:30	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	4
18:30	18:45	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
18:45	19:00	0	2	0	0	0	0	0	0	0	0	0	0	0	0	1	1

Bus

Time		North Approach Port Stephens Dr				East Approach Nelson Bay Rd				South Approach Jessie Rd				West Approach Nelson Bay Rd			
Period Start	Period End	U	R	SB	L	U	R	WB	L	U	R	NB	L	U	R	EB	L
6:00	6:15	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0
6:15	6:30	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6:30	6:45	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0
6:45	7:00	0	1	0	3	0	1	0	0	0	0	0	0	0	0	0	0
7:00	7:15	0	1	0	2	0	1	1	0	0	0	0	0	0	0	0	0
7:15	7:30	0	4	0	2	1	1	2	0	0	0	0	0	0	0	2	0
7:30	7:45	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	0
7:45	8:00	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0
8:00	8:15	0	1	0	0	0	1	0	0	0	0	0	0	0	0	2	0
8:15	8:30	0	1	0	0	0	0	1	0	0	0	0	0	0	0	1	0
8:30	8:45	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1
8:45	9:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
9:00	9:15	0	0	0	0	0	2	1	0	0	0	0	0	0	0	1	0
9:15	9:30	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0
9:30	9:45	0	2	0	0	0	1	1	0	0	0	0	0	0	0	0	1
9:45	10:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0
15:00	15:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	2
15:15	15:30	0	0	0	0	0	1	2	0	0	0	0	0	0	0	0	2
15:30	15:45	0	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0
15:45	16:00	0	0	1	0	0	0	0	0	0	1	2	0	0	2	1	0
16:00	16:15	0	0	0	0	0	1	1	0	0	1	0	0	0	1	1	0
16:15	16:30	0	0	0	0	0	2	0	0	0	1	3	0	0	2	1	1
16:30	16:45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
16:45	17:00	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0
17:00	17:15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1
17:15	17:30	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
17:30	17:45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
17:45	18:00	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1
18:00	18:15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:15	18:30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18:30	18:45	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0
18:45	19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix B. Public Transport Network Port Stephens

Routes 130, 131, 132, 133, 134, 135

B



Source: Port Stephens Coaches Website, Mar 2018

Appendix C. Proposed Sand Mine DA Plans

PROPOSED SAND MINE

AND ANCILLARY DEVELOPMENT

BEING A CARETAKERS RESIDENCE & MACHINERY SHED

LOT 591 DP 119380

4226 NELSON BAY ROAD, ANNA BAY



Schedule of Drawings			
Sheet	File Number	Description	Revision
1	21800001	TITLE PAGE, LOCALITY SKETCH & TABLE OF CONTENTS	A
2	21800002	OVERALL LAYOUT	A
3	21800003	STAGING PLAN	A
4	21800004	SITE SECTION	A
5	21800005	ADJOINING MINING OPERATIONS	A
6	21800006	REHABILITATION PLAN	A

Designed By

TATTERSALL LANDER PTY LTD
DEVELOPMENT CONSULTANTS IN ENGINEERING, SURVEYING & PLANNING
PO Box 580 RAYMOND TERRACE Phone (02) 4987 1500





A	Original Issue	DS	DS			
REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
* Denote the original signature and date when revision was issued.						

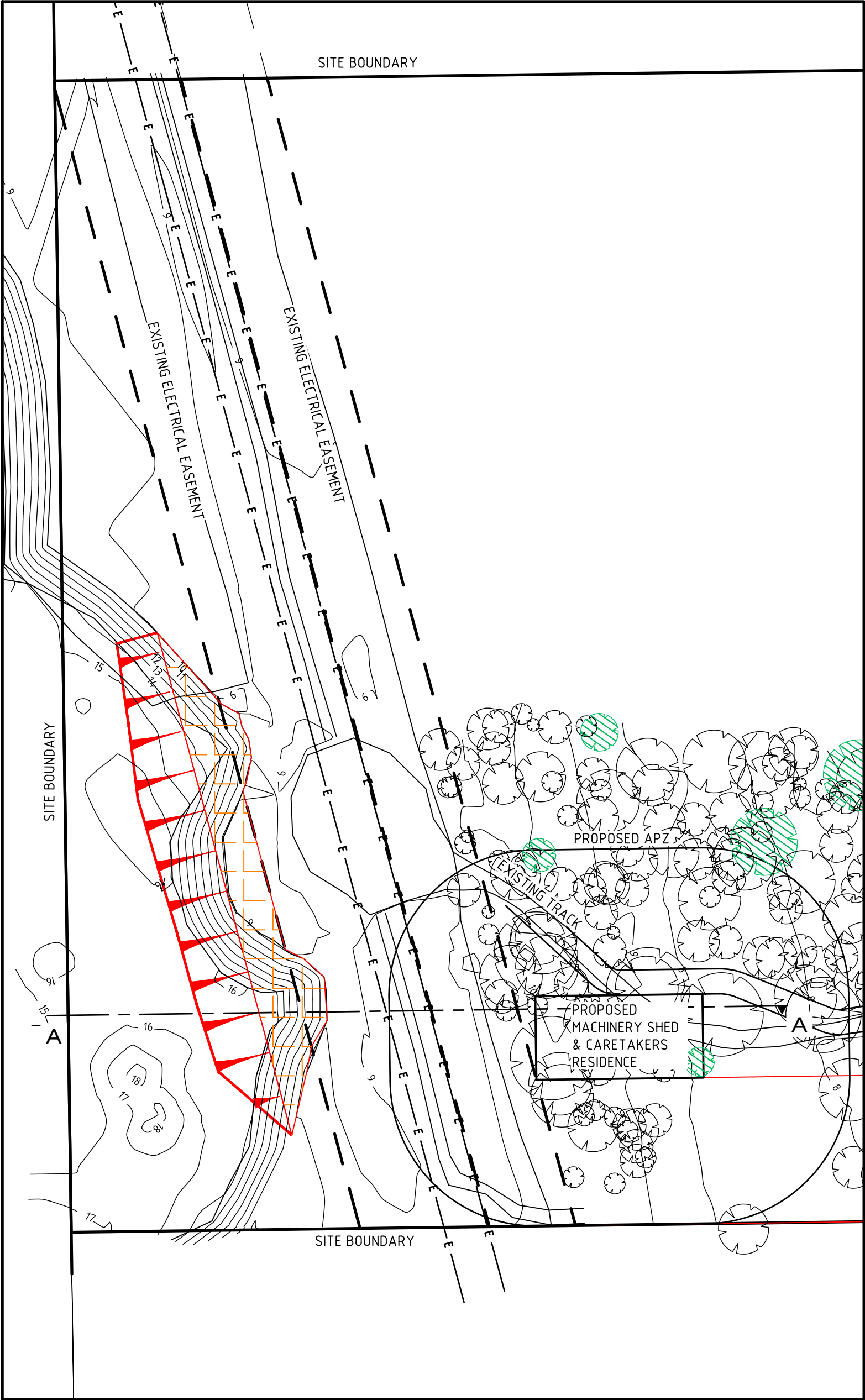
**TATTERSALL
LANDER** PTY LTD
DEVELOPMENT CONSULTANTS
ENGINEERING, SURVEYING & PLANNING
2 Bourke St. P.O.Box 580
RAYMOND TERRACE 2324
Fax (02) 49871733 Phone (02) 49871500

OVERALL LAYOUT
PROPOSED SAND MINE
LOT 591 DP1191380
4226 NELSON BAY RD, ANNA BAY

CLIENT: HAY ENTERPRISES JOB No.: 217111 COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Design.dwg

COUNCIL	PSC	REFERENCE	21800002
PARISH		SHEET SIZE	A1
SCALE	1:1000 on A1	SHEET No.	2
DATE :	Plotted 12/10/10/01/18		

STAGE 1

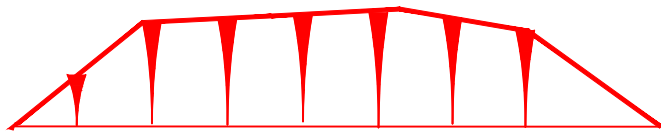


1. PROPOSED APZ: MANAGE/CLEAR AS NECESSARY, CONSISTENT WITH RFS BUSHFIRE PROTECTION GUIDELINES
2. CONSTRUCT MACHINERY SHED/CARETAKERS RESIDENCE
3. EXCAVATE 10m BUFFER SOUTH OF EASEMENT
4. ESTABLISH WORKING ZONE IN 10m BUFFER

EXCAVATED AREA = 1234m²
AREA OF BATTER = 1539m²
CURRENT AVAILABLE SAND VOLUME = 1100m³

LEGEND

DENOTES PROPOSED BATTER TO EXISTING



DENOTES EXISTING POWER EASEMENT
EXISTING CONTOURS
1m INTERVALS



STAGE 1 BASE OF EXTRACTION



STAGE 2 BASE OF EXTRACTION



STAGE 3 EXTENT OF CURRENT VEGETATION SOUTH OF EASEMENT



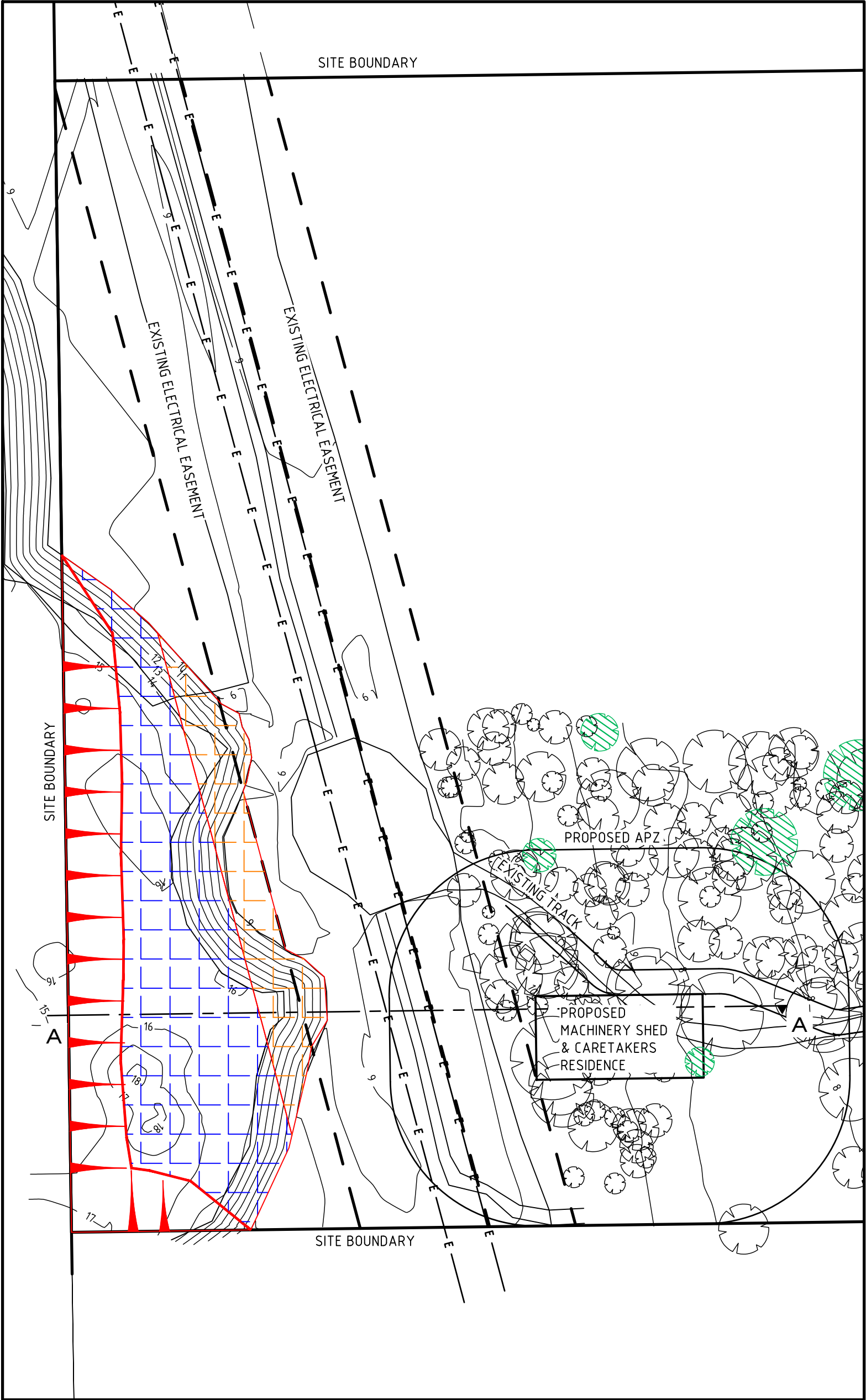
EXISTING TREES WITHIN & IN PROXIMITY TO BUSHFIRE APZ



EXISTING HOLLOW BEARING TREES



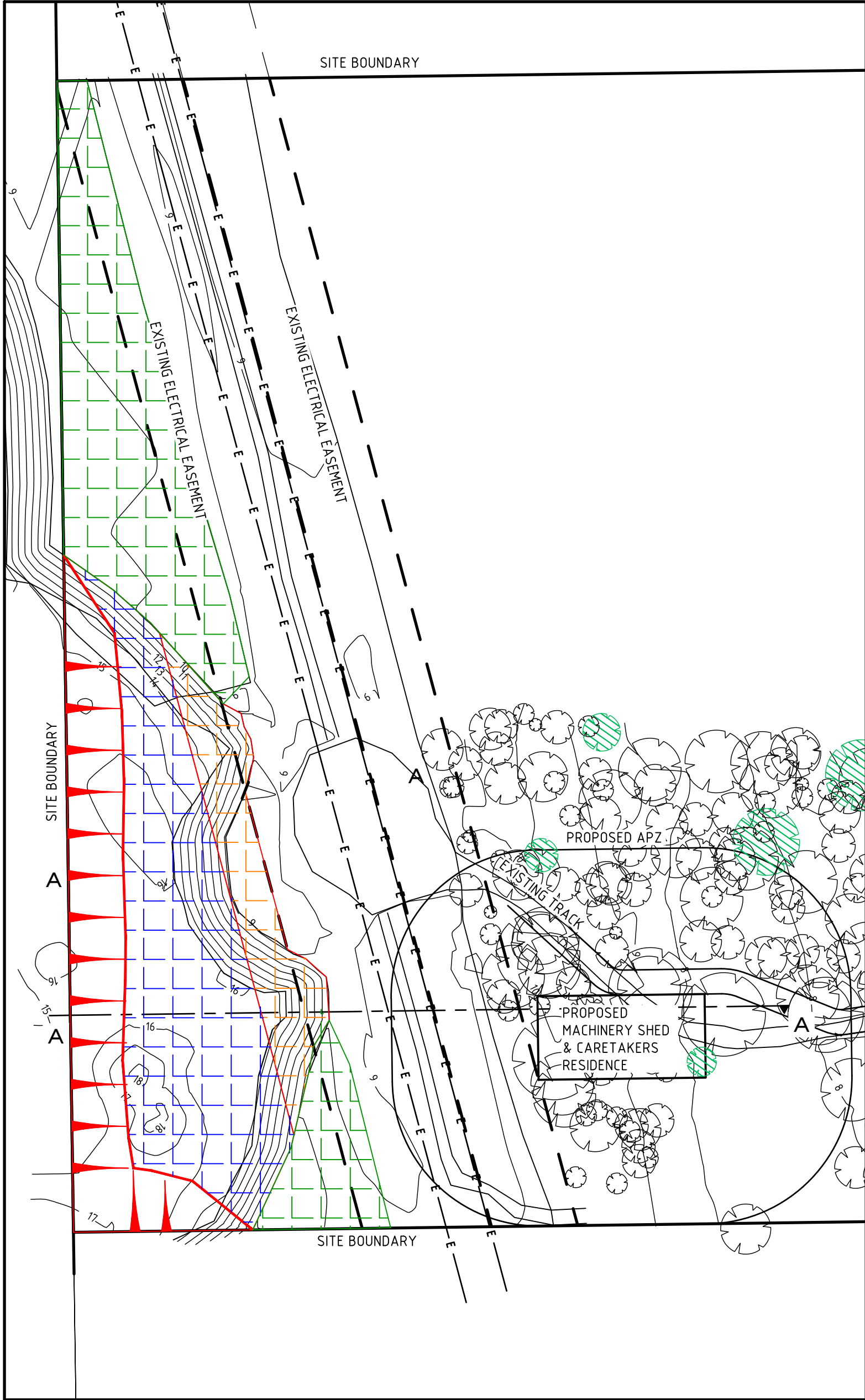
STAGE 2



1. EXCAVATE DUNE TO 9m AHD WITH BATTER TO THE BOUNDARY. SLOPE TO BE CONFIRMED BY GEOTECHNICAL ASSESSMENT.

ADDITIONAL EXCAVATED AREA = 3590m²
ADDITIONAL AREA OF BATTER = 2297m²
CURRENT AVAILABLE SAND VOLUME = 30,700m³

STAGE 3



1. EXCAVATE SAND FROM CURRENTLY VEGETATED AREAS SOUTH OF ELECTRICAL EASEMENT AS DUNE ENCROACHES AND INUNDATES AREA.
2. CONTINUE TO EXCAVATE FROM ESTABLISHED WORKING AREA.
3. EXCAVATION TO BE LIMITED TO 9m AHD.

EXISTING VEGETATED AREA SOUTH OF EASEMENT = 3992m²

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
A	Original Issue	DS	DS			
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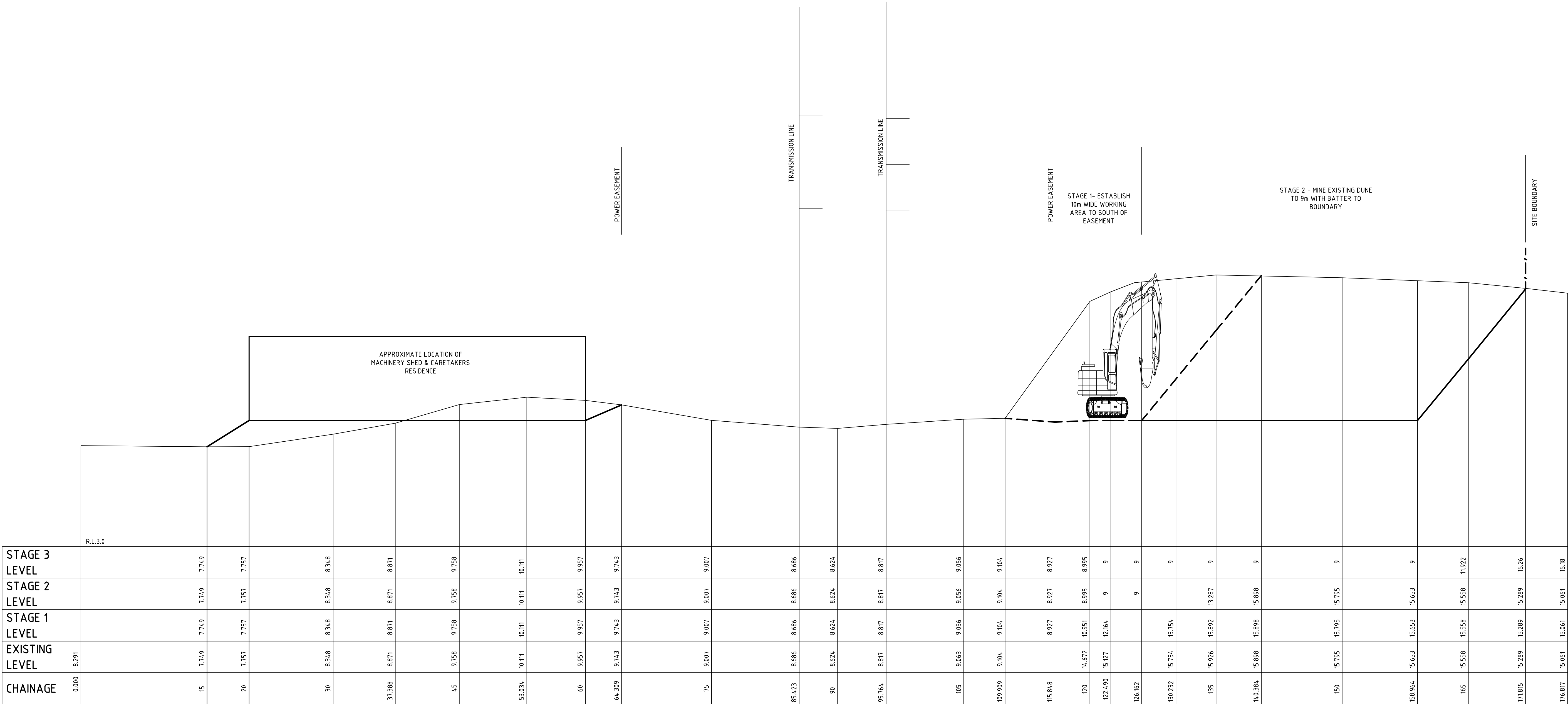
STAGING PLAN
PROPOSED SAND MINE
LOT 591 DP1191380
4226 NELSON BAY RD, ANNA BAY

CLIENT: HAY ENTERPRISES

JOB No.: 217111

COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Design.dwg

COUNCIL PSC	REFERENCE 21800003
PARISH	SHEET SIZE A1
SCALE 1:1000 on A1	SHEET No. 3
DATE :	Plotted 12/11/10/01/18



SECTION A
H=1:250 V=1:100

A	Original Issue	DS	DS				
REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE	
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SITE SECTIONS

PROPOSED SAND MINE

LOT 591 DP1191380

4226 NELSON BAY RD, ANNA BAY

COUNCIL	PSC	REFERENCE	21800004
PARISH		SHEET SIZE	A1
SCALE	1:1000 on A1	SHEET No.	4
DATE	Plotted 12/11/10/01/18		

CLIENT: HAY ENTERPRISES

JOB No.: 217111

COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Design.dwg



A	Original Issue					
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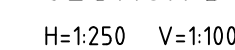
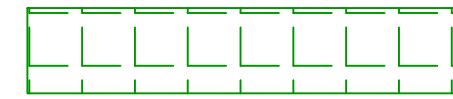
ADJOINING SAND EXTRACTION OPERATIONS

CLIENT: HAY ENTERPRISES

JOB No.: 217111

COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Design.dwg

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DATE : Plotted 12/12 10/01/18		
217111 - Design.dwg		



COUNCIL PSC	REFERENCE 21800006	
PARISH	SHEET SIZE	A1
SCALE 1:1000 on A1	SHEET No. 6	
DATE : Plotted 12-12 10/01/18		

COMPUTER FILE : S:\Client\s\2017\217111\Drawg\217111 - Design.dwg

Appendix H: Waste Assessment



advitech

Report

Site Waste Management Plan

Sand Quarry- 4226 Nelson Bay Rd Anna Bay

Hay Enterprises

15 May, 2018

Rev 1 (Final)

Report Details

Site Waste Management Plan - Sand Quarry- 4226 Nelson Bay Rd Anna Bay

Job #: J0170316, Folder #: F15339, Revision: 0 (Final), Date: 15 May, 2018

Filename: 15339 Site Waste Management Plan Rev1.docx

Prepared For

Hay Enterprises

c/o Tattersall Lander

PO Box 580 Raymond Terrace NSW 2324

Ben Folbigg, Planning and Environmental Officer

Email: ben@tatland.com.au, Telephone: 02 4987 1500

Prepared By

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7 Riverside Drive Mayfield West NSW 2304 PO Box 207 Mayfield NSW 2304

History

Date	Revision	Comments
15 March, 2018	0	Final Issue
15 May, 2018	1	Final Issue

Endorsements

Function	Signature	Name and Title	Date
Prepared by		Colin Barker Manager Process Engineering and Sustainability	15 May, 2018
Authorised for Release by		Rod Bennison Lead Environmental Scientist	15 May, 2018

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APPENDICES

APPENDIX I

Proposed Site Plans

1. INTRODUCTION

Advitech Pty Limited (trading as Advitech Environmental) was engaged by Tattersall Lander Pty Ltd, on behalf of Hay Enterprises, to undertake a series of environmental assessments in order to comply with the Secretary's Environmental Assessment Requirements (SEARs) (1172) for the establishment of a sand quarry at 4226 Nelson Bay Road, Anna Bay (Lot 591 DP1191380). The SEARs were issued on 27 October, 2017, with the requirement to:

Waste - including estimates of the quantity and nature of the waste streams that would be generated or received by the development and any measures that would be implemented to minimise, manage or dispose of these waste streams.

This report constitutes the site waste management plan (SWMP) with respect to the development.

It should be noted that this report was prepared by Advitech Pty Limited for Hay Enterprises ('the customer') in accordance with the scope of work and specific requirements agreed between Advitech and the customer. This report was prepared with background information, terms of reference and assumptions agreed with the customer. The report is not intended for use by any other individual or organisation and as such, Advitech will not accept liability for use of the information contained in this report, other than that which was intended at the time of writing.

2. PROJECT SUMMARY

The current development application is for a proposed sand quarry with the maximum operational intensity/maximum extraction rate of 50,000 m³ per annum. The development is considered necessary in order to maintain access to a high voltage electricity supply easement along the Southern boundary. Access to the electricity supply easement is considered at risk due to the ongoing encroachment of sand dunes.

Irrespective of the anticipated commercial nature of the quarry and the proposed extraction activities, from a waste generation/management perspective, the development is more akin to a residency and comparable to its neighbours along Nelson Bay Road. Therefore, it is recommended the development impact be assessed as equivalent to a residential block regarding waste collection and disposal services. Consequently, utilisation of:

- The Port Stephens LGA domestic waste collection system is considered the most appropriate solid waste disposal method; and
- Installation of an approved anaerobic/aerobic domestic waste water treatment system is considered most appropriate for grey water and black water treatment and disposal.

2.1 Operations Included

The operations/activities proposed for the site will generate both one-off waste streams in the construction/development phase and ongoing waste streams. Proposed operations/activities likely to contribute to the waste generation at the site include:

- Green waste generated during site works and construction;
- Ongoing green waste arisings;
- Sand mining operations to prevent encroach of coastal dunes onto electricity distribution easement;
- Storage of mobile equipment and auxiliary equipment; and
- General domestic wastes including packaging waste.

2.2 Operations Specifically Excluded

A number of operations/activities have been specifically excluded from the scope of this development application. They include:

- Processing and packaging of raw extracted sand materials; and
- Maintenance and repairs of heavy mobile equipment.

3. WASTE GENERATION AND TREATMENT/DISPOSAL

3.1 Waste Sources

The waste streams to be generated by the proposed development include:

1. Green waste;
2. Construction waste;
3. Blackwater and greywater; and
4. General domestic waste.

As previously articulated, the waste streams to be generated are typical of a residential dwelling in the local Port Stephens area. Consequently, the recommended waste management services/strategies include utilisation of:

- The Port Stephens LGA domestic waste collection system is considered the most appropriate solid waste disposal method; and
- Installation of an approved anaerobic/aerobic domestic waste water treatment system is considered most appropriate for grey water and black water treatment and disposal.

3.2 Green Waste

3.2.1 Generation Pattern

Green waste from the sand quarry site is generated from the following sources:

- Clearing vegetation for the construction of the machinery shed/caretakers residence/ site office, intersection upgrade and haul route realignment;
- Removal of dead vegetation from within the sand extraction area; and
- Continual upkeep of the vegetation surrounding the caretaker's residence and haul route.

3.2.1.1 Construction Phase

The cleared area including the proposed building bush fire asset protect zone (APZ) covers approximately 10,000 m²; approximately 2,500 m² of this area is within the easement and is already cleared.

The following assumptions have been utilised in order to estimate the potential mass of green waste to be generated prior for the construction phase of the project:

- It is estimated up to 100 trees will be removed from the 7,500 m² area;
- The average diameter of each tree removed is 300 mm to 350 mm; and
- The average height of each tree removed is 10 metres to 12 metres and weighs approximately 1,000 kg.

3.2.1.2 Anticipated Annual Arising

According to the 2010/2011 Waste Generation and Resource Recovery in Australia (WGGRA) database, the garden organics disposal rate is 50 kg/person/year. Assuming there will be between 1 and 2 residents living on-site, 50 - 100 kg/year (0.12 - 0.45 m³/year¹) of garden organic waste is likely to be generated. Given, the land lot is approximately 13 hectares, the anticipated volume of garden organic waste is readily managed onsite.

3.2.2 Proposed Treatment/Disposal Method

Any vegetation removed for the construction of the caretaker's residence/site office/machinery shed; intersection upgrade and site access improvements will be mulched on site and spread for soil improvement purposes outside of the identified APZ.

Consequently, the estimated mass of mulch produced during the construction phase clearing operations is 100 tonnes. Once mulched and spread to a depth of around 100 mm, this quantity of mulch would be spread over an area of approximately 3,000² m² on the site as a one off soil improvement activity.

It is anticipated that a maximum of 100 kg/year (0.45 m³/year) of green waste will be generated and managed onsite. If generated during a single pruning/garden maintenance event, this quantity would cover 50 m² of garden area with mulch to a depth of only 9 mm per annum.

It should be noted that two on call clean ups of bulky waste and/or green waste and monthly green waste drop-off services are also available each year if required for residents in the Port Stephens local government area.

¹ Density of garden waste organics varies from 227 kg/m³ to approximately 450 kg/m³.

² The uncompacted bulk density of mulch is approximately 330 kg/m³.

3.3 Construction Waste

3.3.1 Generation Pattern

Construction waste from the sand quarry site will be generated from the construction of the machinery shed/caretakers residence/site office, intersection upgrade and haul route realignment.

3.3.2 Proposed Treatment/Disposal Method

A nominated contractor/builder will be responsible for the construction of the machinery shed/caretakers residence/site office. The construction waste management is managed by the nominated contractor/builder. It is expected the contractor will consider the following measures:

- Ordering the right quantities of materials (Purchasing Policy);
- Prefabrication of materials;
- Re-using formwork;
- Modular construction and basic designs to reduce the need for off-cuts;
- Minimising site disturbance and limiting unnecessary excavation;
- Careful source-separation of off-cuts to facilitate re-use, resale or efficient recycling;
- Choice of landscaping to reduce green waste outside of the designated APZ area; and
- Co-ordination and sequencing of various trades.

The following assumptions have been utilised in order to estimate the potential mass of construction waste to be generated during the construction phase of the project:

- It is estimated approximately 2 - 20% of all materials ordered will end up as waste materials (2.5% will be used for this estimate given much of the construction material mass will be the concrete slab(s) and prefabricated steel sections, etc.) (WALGA, 2014);
- The floor area for the residence and the machinery shed combined is to be 800 m²; and
- The mass of single storey domestic type constructions (including foundations)³ is approximately 1,000 kg/m² of floor area.

The total mass of waste construction materials to be delivered to the Port Stephens Resource Recovery Centre is therefore estimated to be around 20 tonnes.

A minor quantity of incidental construction waste (labels, plastic bags, fixture packaging, cardboard boxes, etc) will also be generated. This will report to an on-site skip bin (to be collected by a contracted bin hire company).

³ See http://old.seattletimes.com/html/asktheexpert/2002122968_homehay19.html

3.4 Blackwater and Greywater

3.4.1 Generation Pattern

Blackwater and greywater from the sand quarry site will be generated from the following sources:

- Blackwater from portable toilets provided during the construction of the caretaker's residence;
- Blackwater from toilets in the caretaker's residence; and
- Greywater from the bathroom, kitchen and laundry in the caretaker's residence.

The average water consumption of Australian residents is around 340 litres/person/day⁴ (varying from a minimum of around 100 litres/person/day up to 900 litres/person/day in some areas) and much of this ultimately reports as blackwater and greywater.

3.4.2 Proposed Treatment/Disposal Method

All black water produced from portable toilets during the construction operations will be collected by a hired contractor on a regular basis.

The caretaker's residence will have an on-site septic system to accommodate any blackwater and greywater produced. Effluent (treated wastewater) from septic tanks will be released onto the property through absorption trenches. The septic system will be regularly inspected by the resident and routinely emptied of sludge as required⁵.

The septic tank system to be installed will be suitably sized to cater for all anticipated site activity.

The proposed development will not add any wastewater treatment demand on the local sewerage network.

3.5 Domestic Waste

3.5.1 Generation Pattern

Domestic waste from the sand quarry site is generated from the following sources:

- Household domestic waste from the caretaker's residence; and
- General waste from site office lunch room.

It is estimated approximately 600 kg/person/year of domestic waste will be produced (*Hunter Councils Waste Avoidance and Resource Recovery Strategy 2014-2021*). Assuming there will be 1-2 residents living onsite, 12 - 23 kg/week of waste will be generated. Approximately 52% of the waste generated is considered to be recyclable.

3.5.2 Proposed Treatment/Disposal Method

All general and household wastes will be either disposed in the 240 litre red bin for weekly collection or recycled in the 240 or 360 litre yellow bin for fortnightly collection by Port Stephens Council.

It should be noted two on call clean ups of bulky waste and/or green waste are available each financial year for residences in the Port Stephens local government area.

⁴ See <http://www.rwcc.nsw.gov.au/save-water/average-water-use>

⁵ See <https://www.olg.nsw.gov.au/sites/default/files/Easy-septic-guide.pdf>

4. CONCLUSION

Advitech expects the quantity of waste generated at the 4226 Nelson Bay Rd, Anna Bay (Lot 591 DP1191380) can be adequately managed onsite or through the local Council waste collection services.

5. REFERENCES

The following information was used in the preparation of this report:

1. Department of Sustainability, Environment, Water, Population and Communities, 2014. *Waste Generation and Resource Recovery in Australia (WGGRA) database*.
2. Hunter Councils Inc. Environment Division, 2014. *Hunter Regional Waste Avoidance & Resource Recovery Strategy 2014-2021*, Hunter Councils, NSW Thornton.
3. NSW Department of Local Government, 2000. *The Easy Septic Guide*. Developed by Social Change Media for the New South Wales Department of Local Government.
4. Port Stephens Council, *Resident Services - Rubbish and Recycling*, <http://www.portstephens.nsw.gov.au/live/resident-services/rubbish-and-recycling>,
5. Tattersall Lander, 2018. *Proposed Sand Mine Drawings - Lot 591 DP 119380 4226 Nelson Bay Road, Anna Bay*.
6. Western Australian Local Government Association (WALGA), 2014. *Construction Waste Management Plan Guidelines: A Resource for Western Australian Local Government, Developers, Property Owners and Builders*.



Appendix I

Proposed Site Plans

PROPOSED SAND MINE
AND ANCILLARY DEVELOPMENT
BEING A CARETAKERS RESIDENCE & MACHINERY SHED
LOT 591 DP 119380
4226 NELSON BAY ROAD, ANNA BAY



Schedule of Drawings		
Sheet	File Number	Description
1	21800001	TITLE PAGE, LOCALITY SKETCH & TABLE OF CONTENTS
2	21800002	OVERALL LAYOUT
3	21800003	STAGING PLAN
4	21800004	SITE SECTION
5	21800005	ADJOINING MINING OPERATIONS
6	21800006	REHABILITATION PLAN



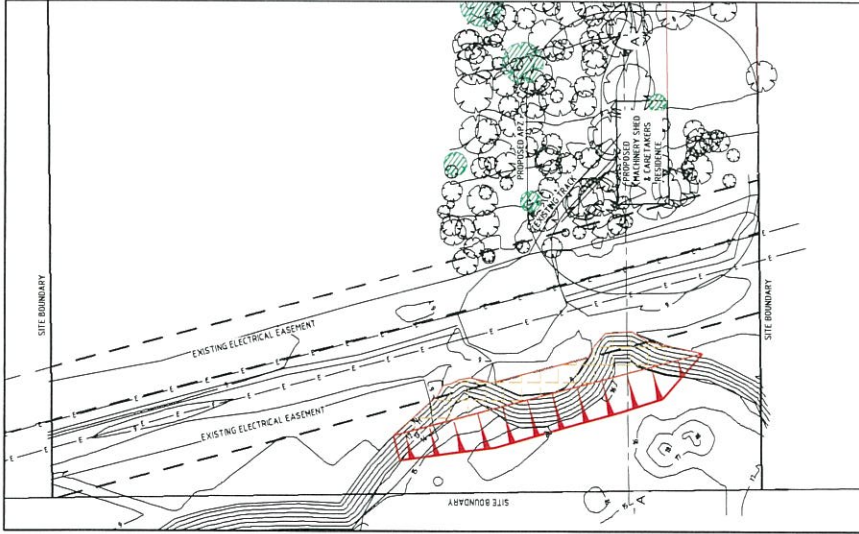
REV	DETAILS OF AMENDMENT	ISSUED	BY	CHECKED	BY	DATE
A	Original Issue					

TATTERSALL LANDER LTD
ENVIRONMENTAL CONSULTANTS
ENGINEERING, SURVEYING & PLANNING
2 BOURKE ST. P.O. BOX 500
RAYMOND TERRACE 2324
Ph (08) 4477281 Fax (08) 4477560

ADJOINING SAND EXTRACTION OPERATIONS

COUNCIL		REFERENCE
PSC		21000005
PARCH	SHEET SIZE	A1
SCALE	SHEET No	
14,000 cm A1	5	
DATE :		Printed 12/12/10/01/18
21TH - Designing		

STAGE 1



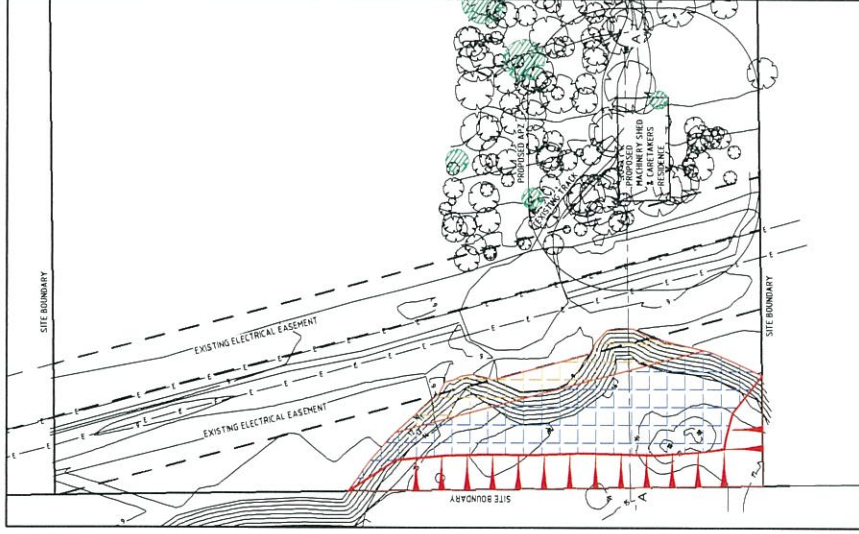
1. PROPOSED APZ MANAGEMENT/CLEAR AS NECESSARY, CONSISTENT WITH RPS BUSHFIRE PROTECTION GUIDELINES
2. CONSTRUCT MACHINERY SHED/CARETAKERS RESIDENCE
3. EXCAVATE 10m BUFFER SOUTH OF EASEMENT
4. ESTABLISH MOWING ZONE IN 10m BUFFER

EXCAVATED AREA = 1234m²
AREA OF BATTER = 839m²
CURRENT AVAILABLE SAND VOLUME = 1100m³

LEGEND

- DENOTES PROPOSED BATTER TO EXISTING
- DENOTES EXISTING POWER EASEMENT
- EXISTING CONTOURS 1m INTERVALS
- STAGE 1 BASE OF EXTRACTION
- STAGE 2 BASE OF EXTRACTION
- STAGE 3 EXTENT OF CURRENT EXCAVATION SOUTH OF EASEMENT
- EXISTING TREES WITHIN & IN PROXIMITY TO BUSHFIRE APZ
- EXISTING HOLLOW BEARING TREES

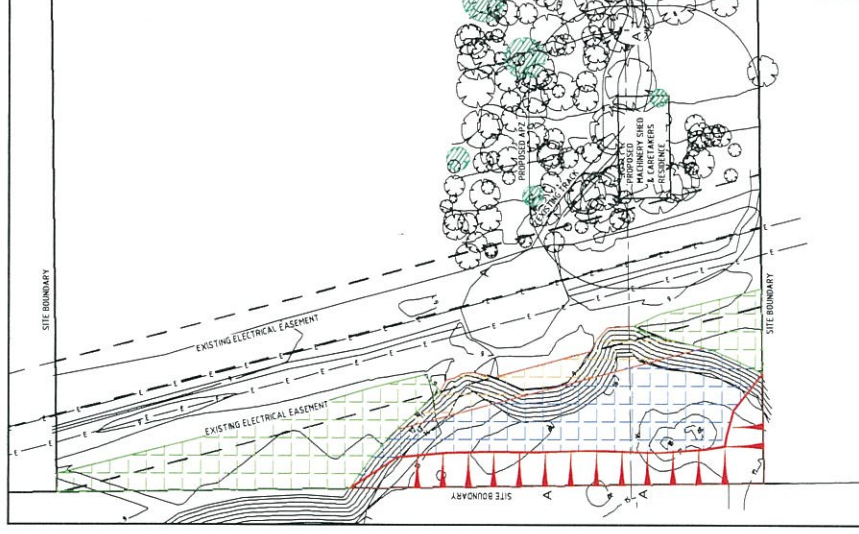
STAGE 2



1. EXCAVATE DUE TO 9m AHD WITH BATTER TO THE BOUNDARY. SLOPE TO BE CONFIRMED BY GEOTECHNICAL ASSESSMENT.

ADDITIONAL EXCAVATED AREA = 3596m²
ADDITIONAL AREA OF BATTER = 2297m²
CURRENT AVAILABLE SAND VOLUME = 30,700m³

STAGE 3



1. EXCAVATE SAND FROM CURRENTLY VEGETATED AREAS SOUTH OF ELECTRICAL EASEMENT AS DUNE ENDOACHES AND INUNDATES AREA.
2. CONTINUE TO EXCAVATE FROM ESTABLISHED WORKING AREA.
3. EXCAVATION TO BE LIMITED TO 9m AHD.

EXISTING VEGETATED AREA SOUTH OF EASEMENT = 3992m²

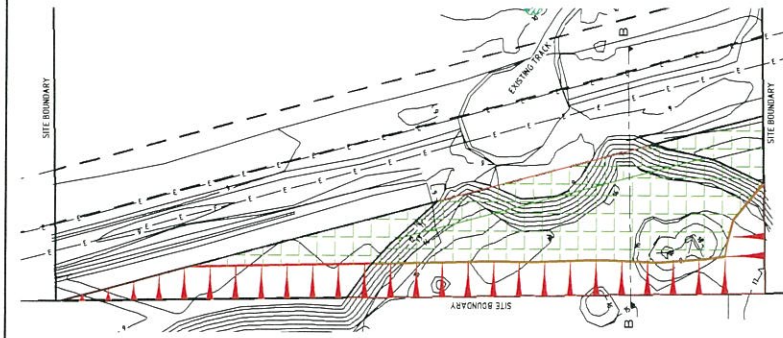
REV	DESCRIPTION	DATE	DESIGNED	CHECKED	APPROVED	DRAWN
A	Original Issue					

TATTERSALL LANDER PTY LTD
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STAGING PLAN
PROPOSED SAND MINE
LOT 591 DP191380
4,226 NELSON BAY RD, ANNA BAY

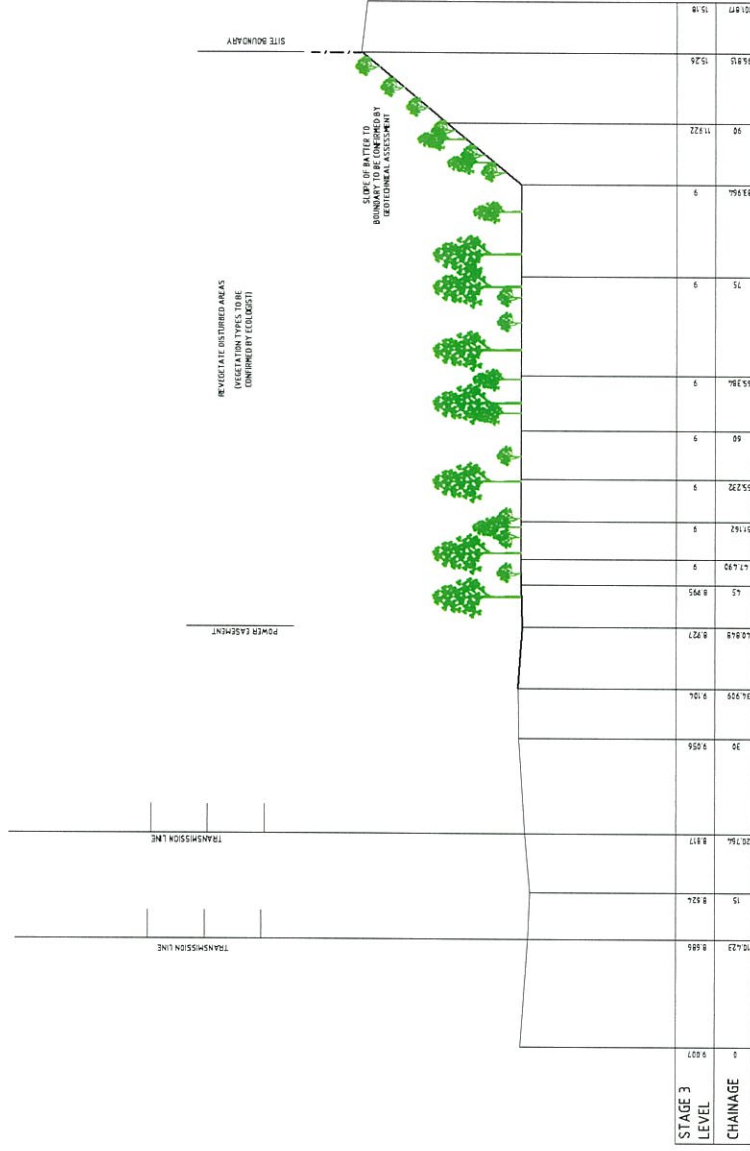
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JOB No.: 21111
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COUNCIL	FILE	REFERENCE
FAIRFAX	2100001	2100001
SUBJECT	2100001	A1
NO. 10132	1000000	3
DATE	10/11/18	10/11/18



BATTERED AREAS
SLOPE STABILISING REVEGETATION

REVEGETATED AREA



SECTION B
H=1550 V=1550

REV	DETAILS OF AMENDMENT	DATE	BY	CHKD	DATE	BY	CHKD
A	Original Issue						

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REHABILITATION PLAN
PROPOSED SAND MINE
LOT 591 DP191380
4226 NELSON BAY RD, ANNA BAY

CONTRACT NO.	PROJECT NO.	REFERENCE
PA0001	1000 m A1	A1
SCALE	DATE	PROJECT No.
1:1000	10/11/18	6

* Denote the original signature and date when revision was issued

Appendix I: Bushfire Assessment



BUSH FIRE THREAT ASSESSMENT

LOT 591 in DP 1191380

***4226 NELSON BAY ROAD
ANNA BAY***



***PREPARED BY
TATTERSALL LANDER
PTY LTD
DEVELOPMENT CONSULTANTS
March 2018***

DEVELOPMENT CONSULTANTS IN ENGINEERING, SURVEYING, PLANNING & ENVIRONMENTAL



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C:\Users\Julie\Documents\217111-Bush Fire Assessment final.docxx

Executive Summary

This Bush Fire Threat Assessment has been prepared to provide comment on a development at 4226 Nelson Bay Road, Anna Bay (Lot 591 in DP 1191380). The proposed development is a sand mine and also includes a machinery shed with a care takers residence within the shed.

It is considered that the proposed development is compliant with *Planning for Bush Fire Protection (2006)* as it meets the aim and objectives. The machinery shed and caretakers residence is to be constructed to BAL-19 AS3959-2009 and a 35 metre APZ is to be constructed around this shed/residence.

1.0 INTRODUCTION

Tattersall Lander Pty Ltd has been commissioned to undertake a Bush Fire Threat Assessment for a proposed development at 4226 Nelson Bay Road, Anna Bay, in the Port Stephens Local Government Area (the LGA) – the property is identified as Lot 591 in DP 1191380. This Bush Fire Threat Assessment is based upon the guidelines as defined in the document, *Planning for Bush Fire Protection Guidelines (2006)*, which has been written by the NSW Rural Fire Service. This assessment outlines the risk posed from bush fire, and hence defines the constraints placed upon the proposed development.

Specifically this report has been prepared by myself (Ben Folbigg); I have a Diploma in Planning for Bushfire Protection and am BPAD accredited (Level 2 – BPAD31379) with the FPA Australia.



Figure 1 – Site Location

2.0 METHODOLOGY

This assessment is conducted entirely in accordance with the guidelines, as outlined in *Planning for Bush Fire Protection (NSW Rural Fire Service) 2006*.

This assessment:

- identifies the slope and aspect of the property;

- identifies all vegetation categories within 140 metres of the site;
- determines the Bush Fire Attack Category (Fire Danger Index – FDI) which applies to the development;
- identifies Asset Protection Zones/Setbacks;
- identifies the Bush Fire Construction (Bush Fire Attack Level – BAL) required in relation to the above for the proposed development (AS 3959-2009)

3.0 SITE DESCRIPTION

The subject site is a primarily undeveloped rural lot comprising 13.12 hectares. The site is accessed off Nelson Bay Road, which is a two way bitumen sealed road bordering the north of the site, and at this location the road is divided.

There is significant vegetation within the site and this vegetation is forest. The southern portion of the site contains an electrical easement and an encroaching sand dune. With regard to structures, there is a dwelling and a shed located towards the front of the site. An access track traverses the site in an approximately north south direction, commencing at Nelson Bay Road and ending at the electrical easement.

There are minor variations in the topography within the site, with small hollows, however, in reality, the site is flat.

An aerial photograph of the site and surrounds is provided in Appendix A. These aerial photographs do not show the extent of the encroachment of the sand dune system upon the easement.

The site is located in the Port Stephens LGA, which is in the Greater Hunter District and hence is afforded a Fire Danger Index rating (FDI) of 100.

4.0 THE PROPOSAL

The proposal is for a sand extraction industry which will include a machinery shed and caretakers/managers residence; this residence shall be located within the machinery shed for simplicity and to also minimise the requirement for vegetation removal.

There are to be no structures within ten metres of the proposed shed/residence.

Compliance shall be achieved by ensuring that the aims and objectives of *Planning for Bush Fire Protection* (PBP) are met. The inclusion of the

residence in the proposal results in the requirement to construct the shed to an appropriate BAL in relation to a relevant APZ and it is considered that a BAL-19 would be appropriate.

5.0 LEGISLATION

The proposal is for a machinery shed and caretakers residence – the sand mine component itself has no structures and as such is not assessable with regard to bush fire protection; Council is the determining authority under S79BA of the *Environmental Planning and Assessment Act (1979)* as the development is not integrated, nor is it Special Fire Protection Purpose (SFPP) development under the guidelines. The proposal does not require referral to the RFS.

The proposal is to comply with *Planning for Bush Fire Guidelines (2006)*, and specifically the proposal is to meet the aims and objectives, which are stated below.

Aim

The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

Objectives

- (i) afford occupants of any building adequate protection from exposure to a bush fire;*
- (ii) provide for a defensible space to be located around buildings;*
- (iii) provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;*
- (iv) ensure that safe operational access and egress for emergency service personnel and residents is available;*
- (v) provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ); and*
- (vi) ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting).*

6.0 SITE ANALYSIS

6.1 Northern Aspect

The northern aspect presents forest for more than 140 metres and the slope under the vegetation is in the upslope/flat category. The proposed shed is to be located approximately 130 metres from the closest part of the northern boundary which will allow for an APZ to be located wholly within the subject site.

6.3 Southern Aspect

The southern aspect presents forest followed by an electrical easement and then a sand dune system – there is a small section of remnant forest between/on the sand dune system and the electrical easement. The shed will be located approximately 130 metres from the southern boundary which shall allow for an APZ to be located wholly within the subject site.

The slope under the vegetation to the south is in the upslope/flat category.

6.4 Eastern Aspect

The eastern aspect presents forest with a slope under vegetation in the upslope/flat category. The proposed shed is to be located a minimum of 35 metres from the eastern boundary to allow for the creation of an adequate APZ wholly within the subject site.

6.5 Western Aspect

The western aspect presents forest with a slope under vegetation in the upslope/flat category. The proposed shed is to be located over 200 metres from the western boundary and this is more than adequate for the required APZ to be located wholly within the subject site.

7.0 SITE ANALYSIS

Aspect	Vegetation Classification	Slope (degrees) Under Vegetation	Distance of Proposed Asset Protection Zone (metres) *	BAL Requirement*
North	Forest	Upslope/flat	35	BAL-19
South	Forest	Upslope/flat	35	BAL-19
East	Forest	Upslope/flat	35	BAL-19
West	Forest	Upslope/flat	35	BAL-19

Table 1

6.0 UTILITIES

6.1 Water

Whilst reticulated water is available to the site, the development will operate off tank water and the reticulated system will not be extended to this area of the lot. A 20,000 litre (minimum) non-combustible rainwater tank will be installed in an appropriate location (next to the shed) and this tank shall be installed in accordance with the requirements of *PBP* (2006), including the fitment of a 65mm Storz outlet. All above ground pipe work and taps to and from this tank shall be metal and a SWS marker is to be installed at the front property boundary and also adjacent to the rainwater tank so that it is visible from the access track. A hardstand area shall be constructed so that fire fighting vehicles are able to get within at least 4 metres of this tank and there is to be shielding of the tank from any fire threat.

6.2 Electricity

Electrical supply to the shed shall be underground to avoid any possibility of this electrical supply resulting in an ignition source. This is acceptable and compliant with *PBP 2006*.

6.3 Gas

No reticulated gas shall be available to the shed. No bottled gas is proposed to be installed.

7.0 ACCESS

7.1 Road Capacity

The subject site is accessed via Nelson Bay Road which is capable of carrying fully laden fire fighting vehicles, including tankers. The area within the site is to be accessed via an all-weather access road which is to be 6 metres in width and with a minimum 4 metre vertical clearance. This width negates the requirement for any passing bays. There are no bridges within the property. The proposed access road will be *PBP* compliant.

7.2 Access and Egress

Access to and from the site is to be primarily directly off Nelson Bay Road. There is a secondary alternate access/egress for use in the event of a bush

fire emergency, and this is via the powerline easement. This is considered acceptable.

8.0 DISCUSSION and RECOMMENDATIONS

The proposed machinery shed and managers/caretakers residence are located so that an appropriate APZ of 35 metres is able to be created around the entire structure and this APZ shall be wholly located within the subject site.

The following recommendations are deemed appropriate:

1. A 35 metre APZ is to be constructed around the machinery shed/residence;
2. The machinery shed/residence is to be constructed to BAL-19;
3. A rainwater tank with a minimum 20,000 litre capacity is to be installed in accordance with *PBP* (2006), including:
 - the tank must be metal or concrete;
 - a 65mm storz fitting with a metal gate or ball valve is to be fitted near the base of the tank;
 - all above ground taps and pipe work is to be metal;
 - a hardstand area is to be constructed to at least within 4 metres of the tank.
4. SWS signage is to be installed, one at the property entrance, and one adjacent to the tank, so that it is visible from the access track.

The proposal meets the aim of *PBP* (2006) through meeting the objectives and how these objectives are met is detailed below.

Aim

The aim of PBP is to use the NSW development assessment system to provide for the protection of human life (including firefighters) and to minimise impacts on property from the threat of bush fire, while having due regard to development potential, on-site amenity and protection of the environment.

Comment – this is achieved through meeting the objectives (below).

Objectives

- (i) *afford occupants of any building adequate protection from exposure to a bush fire;*

Comment – The proposed shed is to be constructed from Colorbond sheeting with a steel frame; it is considered that any occupants of the shed will be afforded a high degree of protection from exposure to any approaching bushfire as a result of the non-combustible nature of the sheds exterior. Additionally, the shed and residence will be constructed to BAL-19 which is acceptable with the proposed 35 metre APZ.

- (ii) *provide for a defensible space to be located around buildings;*
Comment – A 35 metre APZ is proposed around the entire structure and this is an acceptable defensible space.
- (iii) *provide appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and material ignition;*
Comment – The proposed APZ equates to a BAL-19 requirement and this clearly demonstrates that the structure will be well outside of flame zone and hence outside of flame contact.
- (iv) *ensure that safe operational access and egress for emergency service personnel and residents is available;*
Comment – The proposed access track is compliant with *PBP* (2006) except for the length and this is overcome via the electrical easement which is an acceptable secondary access/egress in an emergency event.
- (v) *provide for ongoing management and maintenance of bush fire protection measures, including fuel loads in the asset protection zone (APZ);*
Comment – The proposed APZ is to be managed appropriately in perpetuity (whilst the structure is in existence) and this satisfies this objective.
- (vi) *ensure that utility services are adequate to meet the needs of firefighters (and others assisting in bush fire fighting).*
Comment – The proposed rainwater tank shall ensure that there are adequate services for fire fighting.

The proposal meets the aims and objectives of *PBP* (2006) and therefore must be considered acceptable.

9.0 CONCLUSION

The proposal is for a sand extraction operation which is to include a machinery shed combined with a managers/caretakers residence; the location of this proposal is at the rear of Lot 591 in DP 1191380 which is located at 4226 Nelson Bay Road, Anna Bay, in the Port Stephens LGA.

The proposal has been assessed as per the NSW Rural Fire Service *Planning for Bush Fire Protection Guidelines* (2006).

It is considered that the proposal is compliant with *PBP* (2006) on the proviso that the shed is constructed to BAL-19 (AS3959-2009), a 35 metre

APZ is constructed around the shed, and a rainwater tank is installed in accordance with the requirements of PBP.

10.0 DISCLAIMER

All effort has been made to ensure the accuracy of this report, however, it is noted that bush fires can be unpredictable and this report in no way implies that any part of the proposed development is totally safe from fire.

Additionally it is noted that despite the site details at the time of writing this report, the situation may change; factors resulting in change to bush fire hazard include (but are not limited to) vegetation regrowth and improper maintenance of Asset Protection Zones.

No responsibility is accepted or implied for damage to, or loss of, life and/or property at any time resulting from bush fire or bush fire related issues (or any other factors) on this site.

Appendix A: Aerial photograph



Source: LPI Six Viewer Website
Position of photographs approximate only

Appendix B:

Photographs



Photograph 1



Photograph 2



Photograph 3



Photograph 4



Photograph 5



Photograph 6



Photograph 7



Photograph 8



Photograph 9

Appendix C:

Site Plan with Shed Location

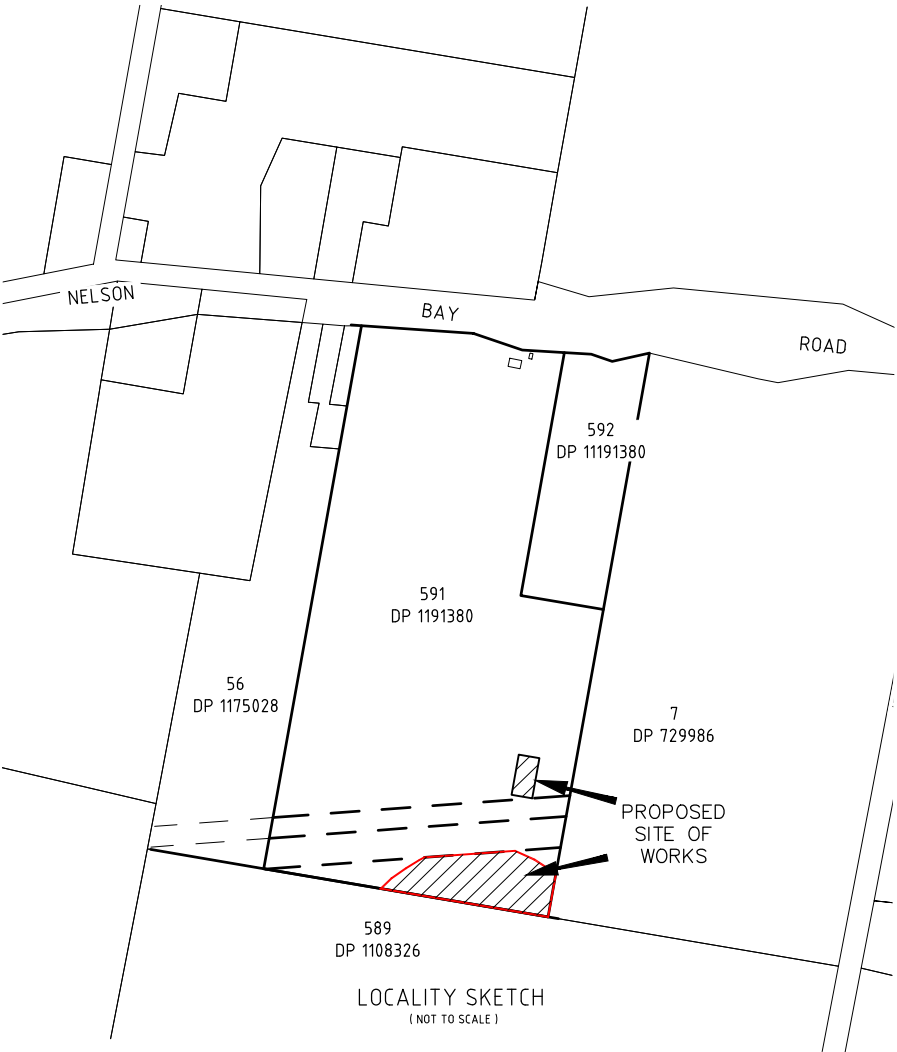
Appendix J: Visual Impact Assessment

PROPOSED SAND EXTRACTIVE INDUSTRY

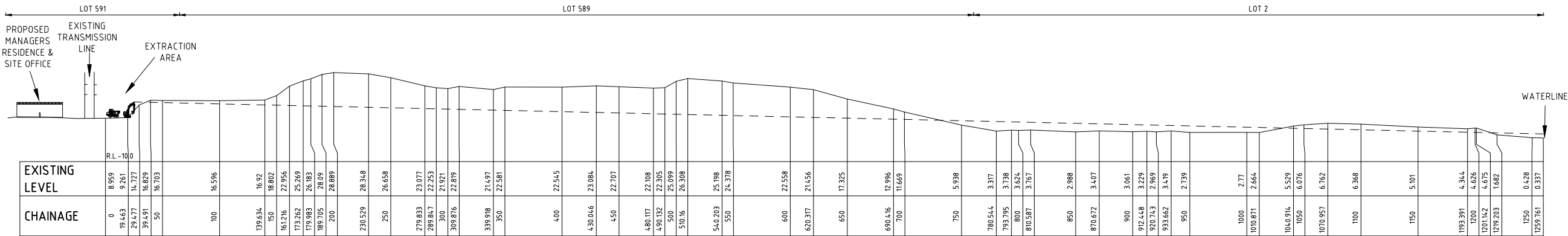
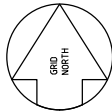
INCLUDING CARETAKERS
RESIDENCE & SITE OFFICE

LOT 591 DP 1191380

4226 NELSON BAY ROAD, ANNA BAY



Schedule of Drawings			
Sheet	File Number	Description	Revision
1	21900014	TITLE PAGE, LOCALITY SKETCH & SCHEDULE OF DRAWINGS	A
2	21900015	STOCKTON BEACH SIGHT LINE PLAN	A
3	21900016	BIRUBI BEACH SURF CLUB SIGHT LINE PLAN	A
4	21900017	4206 ANNA BAY ROAD SIGHT LINE PLAN	A
5	21900018	BAYLIFE CHURCH SIGHT LINE PLAN	A
6	21900019	5 JESSIE ROAD SIGHT LINE PLAN	A



EXISTING LEVEL		8.959	9.261	11.727	16.829	16.703		16.596																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
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SOURCE: GROUND ELEVATIONS FROM
GEOSCIENCE AUSTRALIA'S ELEVATION
INFORMATION SYSTEM WEB PORTAL -
PORT STEPHENS 2012-12-14 1 METRE
RESOLUTION DIGITAL ELEVATION MODEL

REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE
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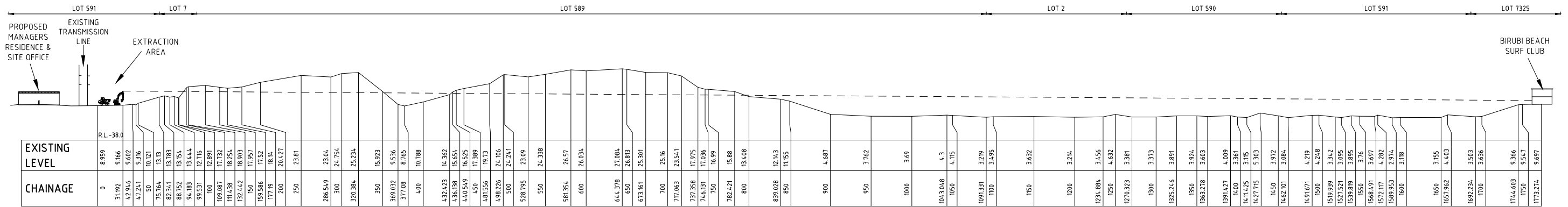
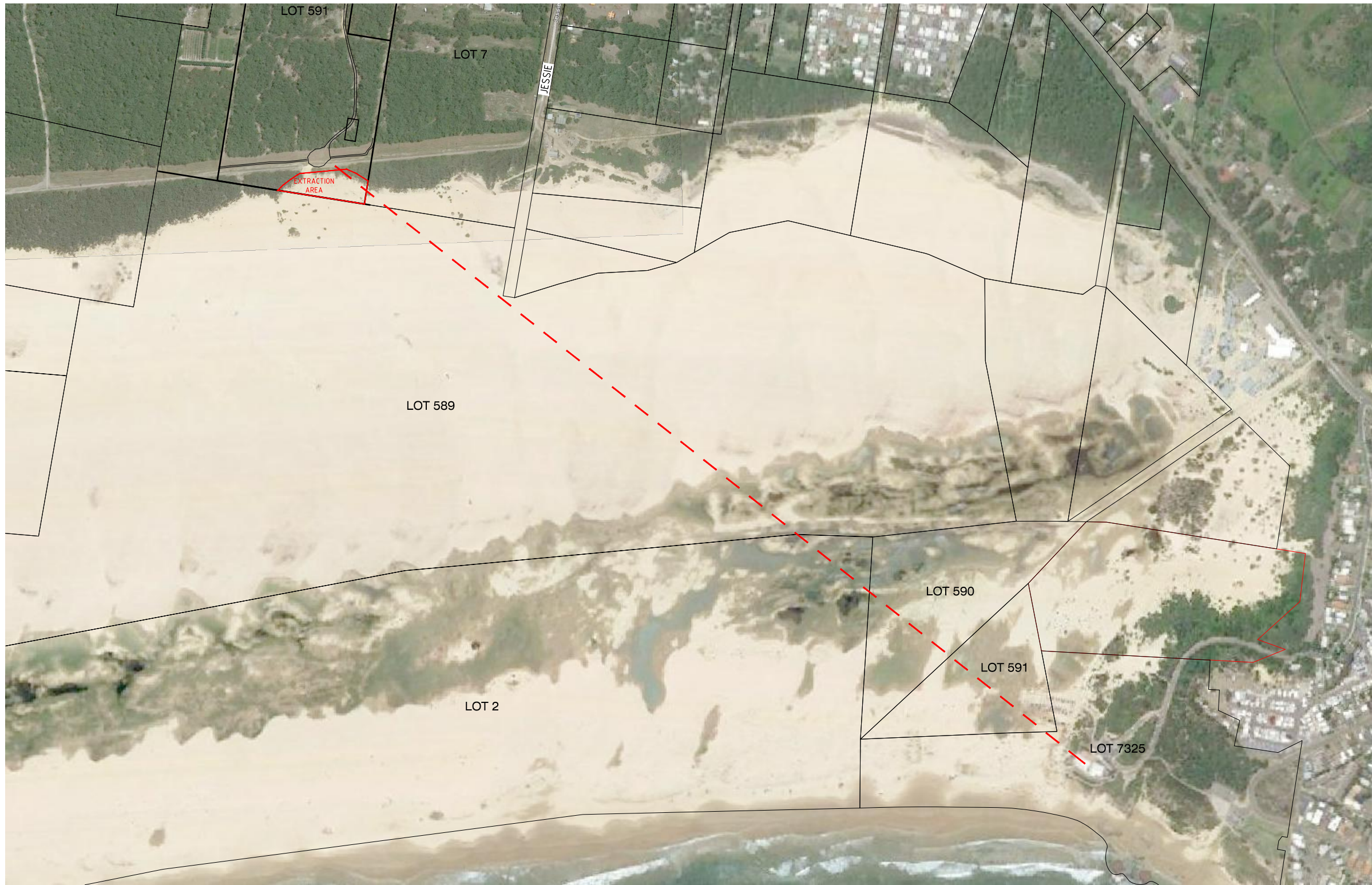
VISUAL IMPACT ON STOCKTON BEACH
PROPOSED SAND EXTRACTION OPERATIONS
LOT 591 DP 1191380

CLIENT: HAY ENTERPRISES

JOB No.: 217111

COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Visual Impact Assessment.dwg

COUNCIL PSC	REFERENCE 21900015
PARISH	SHEET SIZE A3
SCALE 1:8000 on A3	SHEET No. 2
DATE : 11/02/19	Plotted 11:55 11/02/19



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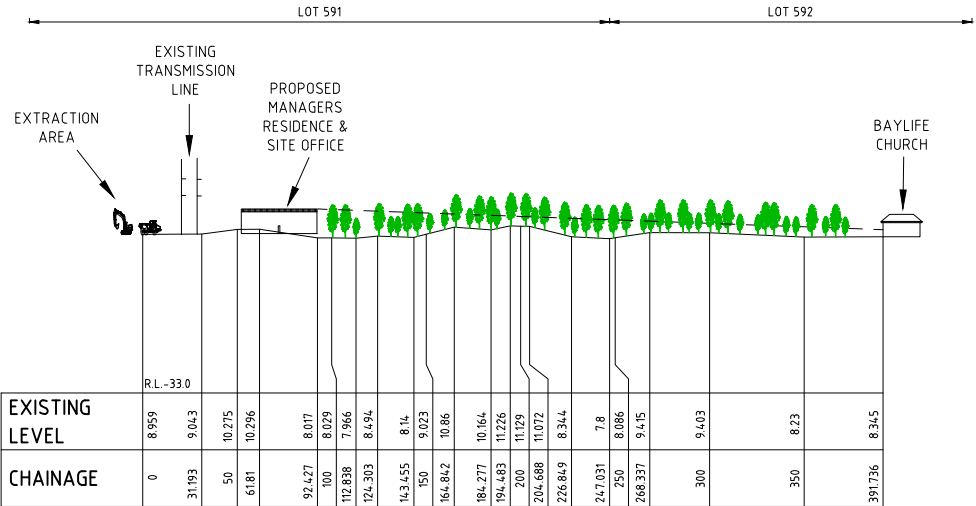
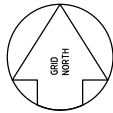
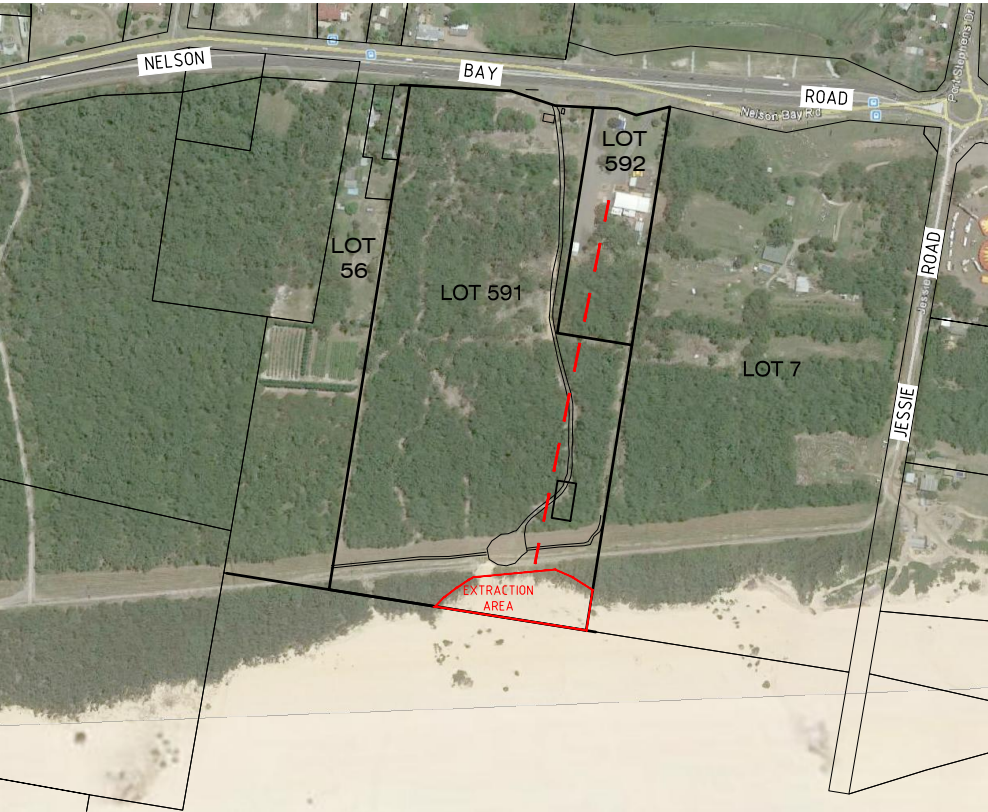
VISUAL IMPACT ON BIRUBI BEACH SURF CLUB
PROPOSED SAND EXTRACTION OPERATIONS
LOT 591 DP 1191380

CLIENT: HAY ENTERPRISES

JOB No.: 217111

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COUNCIL PSC	REFERENCE 21900016
PARISH	SHEET SIZE A3
SCALE 1:8000 on A3	SHEET No. 3
DATE : 11/02/19	Plotted 11:55 11/02/19



H=1:4000 V=1:2000



TYPICAL VEGETATION TO NORTH OF DEVELOPMENT SITE

SOURCE: GROUND ELEVATIONS FROM
GEOSCIENCE AUSTRALIA'S ELEVATION
INFORMATION SYSTEM WEB PORTAL -
PORT STEPHENS 2012-12-14 1 METRE
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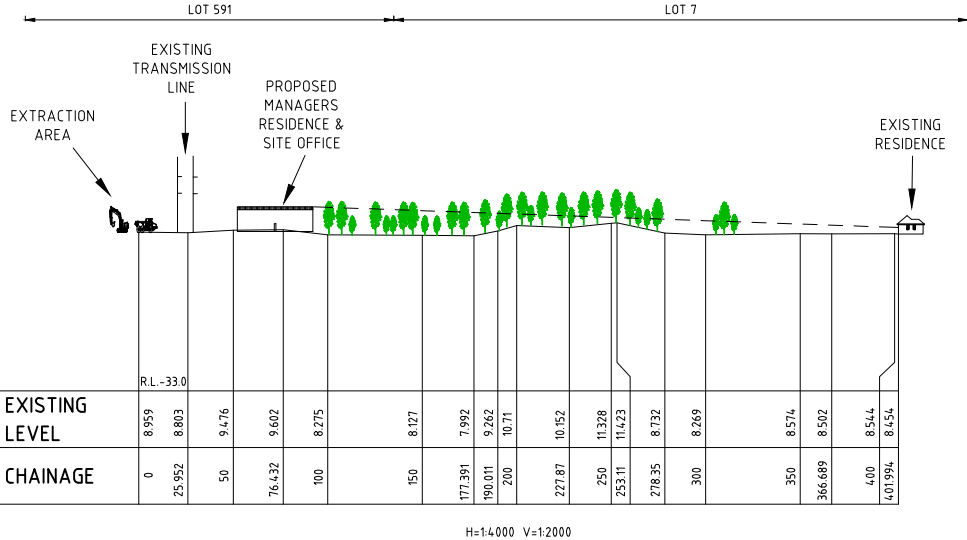
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VISUAL IMPACT ON LOT 592 DP 1191380
BAYLIFE CHURCH, 4236 NELSON BAY RD, ANNA BAY
PROPOSED SAND EXTRACTION OPERATIONS
LOT 591 DP 1191380

COUNCIL PSC	REFERENCE 21900018
PARISH	SHEET SIZE A3
SCALE 1:8000 on A3	SHEET No. 5
DATE : Plotted 11:55 11/02/19	



TYPICAL VEGETATION TO NORTH OF DEVELOPMENT SITE

SOURCE: GROUND ELEVATIONS FROM
GEOSCIENCE AUSTRALIA'S ELEVATION
INFORMATION SYSTEM WEB PORTAL -
PORT STEPHENS 2012-12-14 1 METRE
RESOLUTION DIGITAL ELEVATION MODEL

A	Original Issue		AV	AV					
REV	DETAILS OF AMENDMENT	DESIGNED	DRAWN	CHECKED	APPROVED	DATE			
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VISUAL IMPACT ON LOT 7 DP 729986
5 JESSIE RD, ANNA BAY
PROPOSED SAND EXTRACTION OPERATIONS
LOT 591 DP 1191380

CLIENT: HAY ENTERPRISES
JOB No.: 217111
COMPUTER FILE : S:\Clients\2017\217111\DWG\217111 - Visual Impact Assessment.dwg

COUNCIL PSC	REFERENCE 21900019
PARISH	SHEET SIZE A3
SCALE 1:8000 on A3	SHEET No. 6
DATE :	Plotted 11:55 11/02/19

Appendix K: Social Impact Assessment



Social Impact Assessment

Proposed Anna Bay Sand Extraction & Site Office and Manager's Residence

Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay

June 2019



DEVELOPMENT CONSULTANTS IN ENGINEERING, SURVEYING, PLANNING & ENVIRONMENTAL



Tattersall Lander Pty Limited ABN 41 003 509 215

2 Bourke Street, RAYMOND TERRACE 2324 **All mail to:** PO Box 580

Telephone: (02) 4987 1500 **Fax:** (02) 4987 1733 **Email:** admin@tatland.com.au

"Social Impact Assessment includes the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions. Its primary purpose is to bring about a more sustainable and equitable biophysical and human environment."

(Frank Vanclay (2003) International Principles For Social Impact Assessment, Impact Assessment and Project Appraisal)

Report prepared by: Tattersall Lander Pty. Ltd. June, 2019
Report prepared for: Hay Enterprises (NSW) Pty. Ltd.

Endorsements:

Function	Signature	Name and Position	Date
Written by		Julie Wells Planning Coordinator	June, 2019
Checked by		Bob Lander Director	June, 2019
Authorised by		Bob Lander Director	June, 2019

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Executive Summary

Introduction

Tattersall Lander Pty Ltd has been engaged by Hay Enterprises (NSW) Pty. Ltd. (the proponent) to prepare a Social Impact Assessment (SIA), to inform an Environmental Impact Statement (EIS) to accompany a development application to Port Stephens Council under the *Environmental Planning and Assessment Act, 1979*.

This report documents the detail and associated outcomes of the SIA undertaken by Tattersall Lander on behalf of Hay Enterprises.

The sand extraction operations seek to remove wind deposited sand to natural ground level with an existing 33kV electrical easement and also immediately south of this easement. The proposal seeks to extract a maximum 50,000 cubic metres of sand per year over a period of up to 30 years. The proposed development also incorporates a Site Office and Manager's Residence.

Justification

There is a requirement to maintain the electrical easement free of obstruction. Southerly winds are resulting in continuous sand deposition, causing an ongoing issue with the ability to maintain the easement. The accumulation of these sands is a primary electricity maintenance consideration, and also a potential safety issue.

The removal of the sand from this easement is able to be undertaken on behalf of Ausgrid without consent, however, removal of sand south of this easement requires consent. Removal of sand to the south of the Ausgrid easement, provides an effective buffer to its accumulation within the easement.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the SIA and the associated EIS have each been prepared having regard to the impacts created at that level.

It is expected that through the implementation of the recommended mitigation measures, the proposal will not have any significant impacts.

Existing Site and Land Uses

The legal description of the site is Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay. The land is 13.12 hectares in size.

The property is largely rural in nature. An existing dwelling and shed are located on the site.

The site has direct access to Nelson Bay Road.

The electrical easement is situated towards the south of the site.

Project Description

The proposed development incorporates the following:

- Hay Enterprises (NSW) Pty. Ltd. proposes to establish a sand extraction facility on Lot 591 in DP 1191380, 4226 Nelson Bay Road, Anna Bay. The construction of a Site Office and Manager's Residence is also proposed at the site.
- The sand extraction operations seek to remove wind deposited sand to natural ground level within an existing 33kV electrical easement and also immediately south of this easement. The proposal seeks to extract a maximum 50,000 cubic metres of sand per year for a period of up to 30 years.
- The sand resource is intended for general construction and filling purposes in various locations. Product will be classified as VENM (Virgin Excavated Natural Material) and utilised for bulk filling of land and developments.
- Sand will be loaded via a front-end loader into haulage trucks and removed from the site to market destinations via Nelson Bay Road.
- 6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months.
- 6 part-time employee positions will be required for internal road construction purposes for 2 months.
- 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site.

Stakeholder Consultation

For the purposes of this SIA, the following are considered stakeholders:

- Adjoining land owners
- The wider Anna Bay community
- Relevant Anna Bay Community Group(s)
- Relevant Aboriginal individuals, communities and associations
- Port Stephens Council
- Ausgrid
- Local Businesses
- Relevant statutory and non-statutory agencies

With any commencement of on-site operations, the stakeholder group will be expanded to include:

- Company employees
- Company Management
- Shareholders, if appropriate.

The details of consultation with stakeholders is documented throughout this report.

Conclusion

The proposed sand extraction facility will provide a sand resource suitable for general purposes in the construction industry. Importantly, removal of windblown sand will also ensure that the 33KV electricity easement within the site is kept clear of sand and can be accessed for maintenance purposes.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the SIA and the associated EIS have each been prepared having regard to the impacts created at that level.

The project can be implemented with minimal adverse socio-economic and environmental impacts as demonstrated throughout this report and the associated EIS.

The project is justified on the basis of the efficient utilisation of available existing resources; maintenance of the existing electricity easement and overall economic benefits to local, regional and State economies.

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1 INTRODUCTION

Tattersall Lander Pty Ltd has been engaged by Hay Enterprises (NSW) Pty. Ltd. (the proponent) to prepare a Social Impact Assessment (SIA), to inform an Environmental Impact Statement (EIS) to accompany a development application to Port Stephens Council under the *Environmental Planning and Assessment Act, 1979*.

This report documents the detail and associated outcomes of the SIA undertaken by Tattersall Lander on behalf of Hay Enterprises.

The sand extraction operations seek to remove wind deposited sand to natural ground level within an existing 33kV electrical easement and also immediately south of this easement. The proposal seeks to extract a maximum 50,000 cubic metres of sand per year over a period of up to 30 years. The proposed development also incorporates a Site Office and Manager's Residence.

Justification

There is a requirement to maintain the electrical easement free of obstruction. Southerly winds are resulting in continuous sand deposition, causing an ongoing issue with the ability to maintain the easement. The accumulation of these sands is a primary electricity maintenance consideration, and also a potential safety issue.

The removal of the sand from this easement is able to be undertaken on behalf of Ausgrid without consent, however, removal of sand south of this easement requires consent. Removal of sand to the south of the Ausgrid easement, provides an effective buffer to its accumulation within the easement.

The proposed site building is required for the secure storage of equipment and office operation requirements associated with sand extraction. Occupation of the proposed manager's residence will enable operations to occur in an efficient manner and operational machinery to be retained safely at the site.

It is expected that through the implementation of the recommended mitigation measures, the proposal will not have any significant impacts.

2 BACKGROUND

Existing Site and Land Uses

The legal description of the site is Lot 591 DP 1191380, 4226 Nelson Bay Road, Anna Bay. The land is 13.12 hectares in size and is zoned RU2 Rural Landscape pursuant to Port Stephens Local Environmental Plan (LEP) 2013.

The property is largely rural in nature. An existing dwelling and shed are located on the site.

The site has direct access to Nelson Bay Road.

The electrical easement is situated towards the south of the site.

The following figures and plates illustrate site context and characteristics.

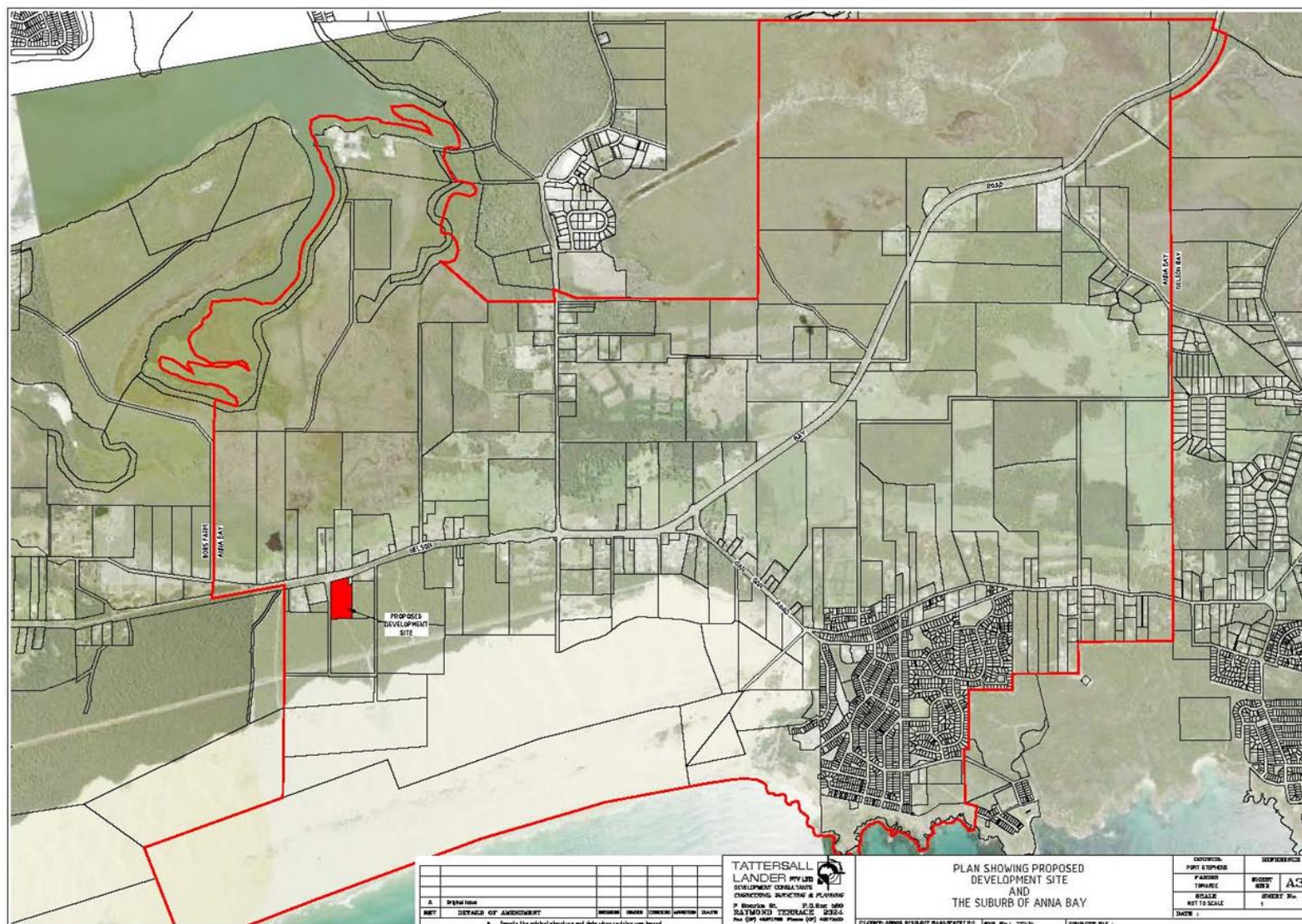


Figure 2-1: Proposed Development Site in Relation to Anna Bay Locality



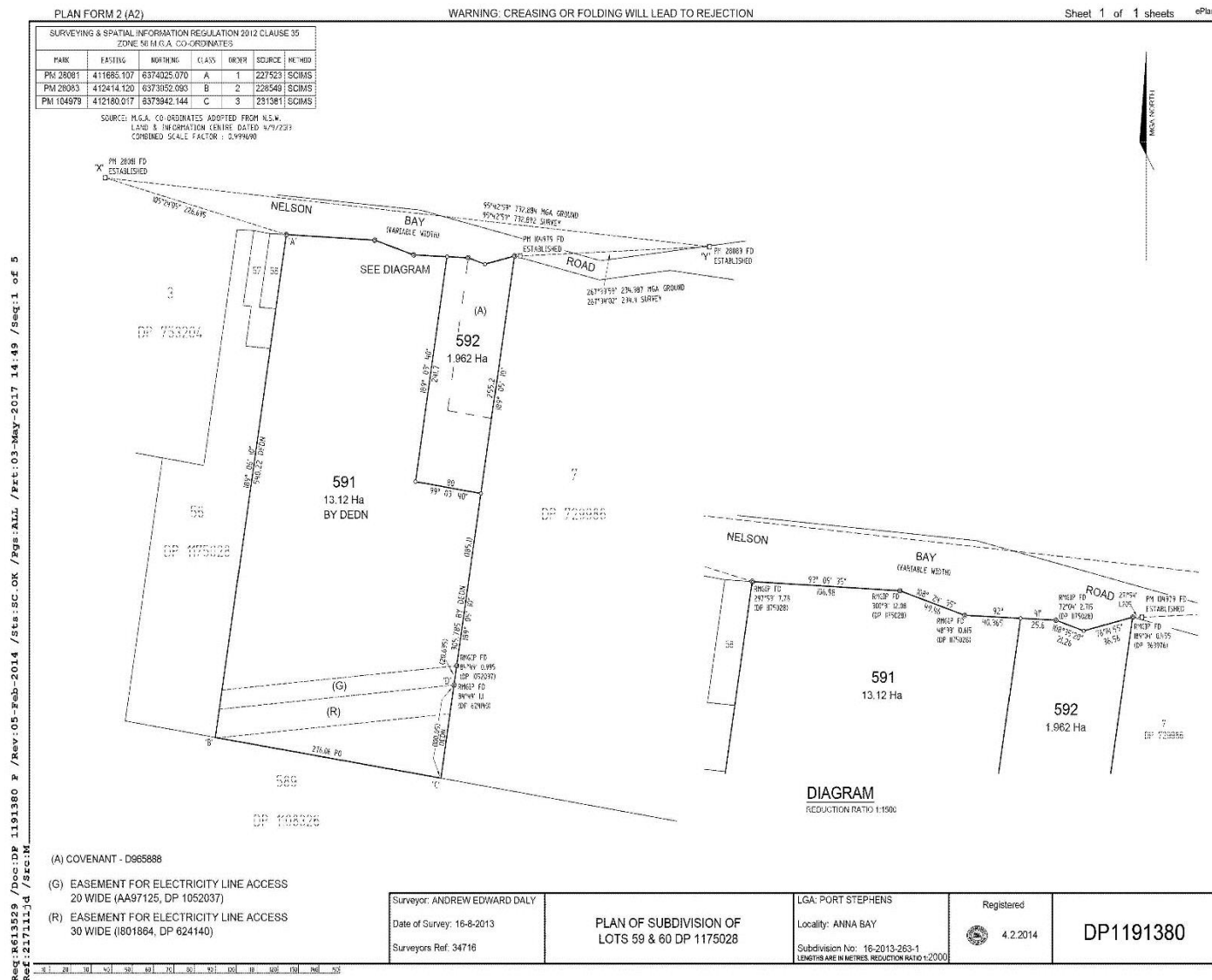
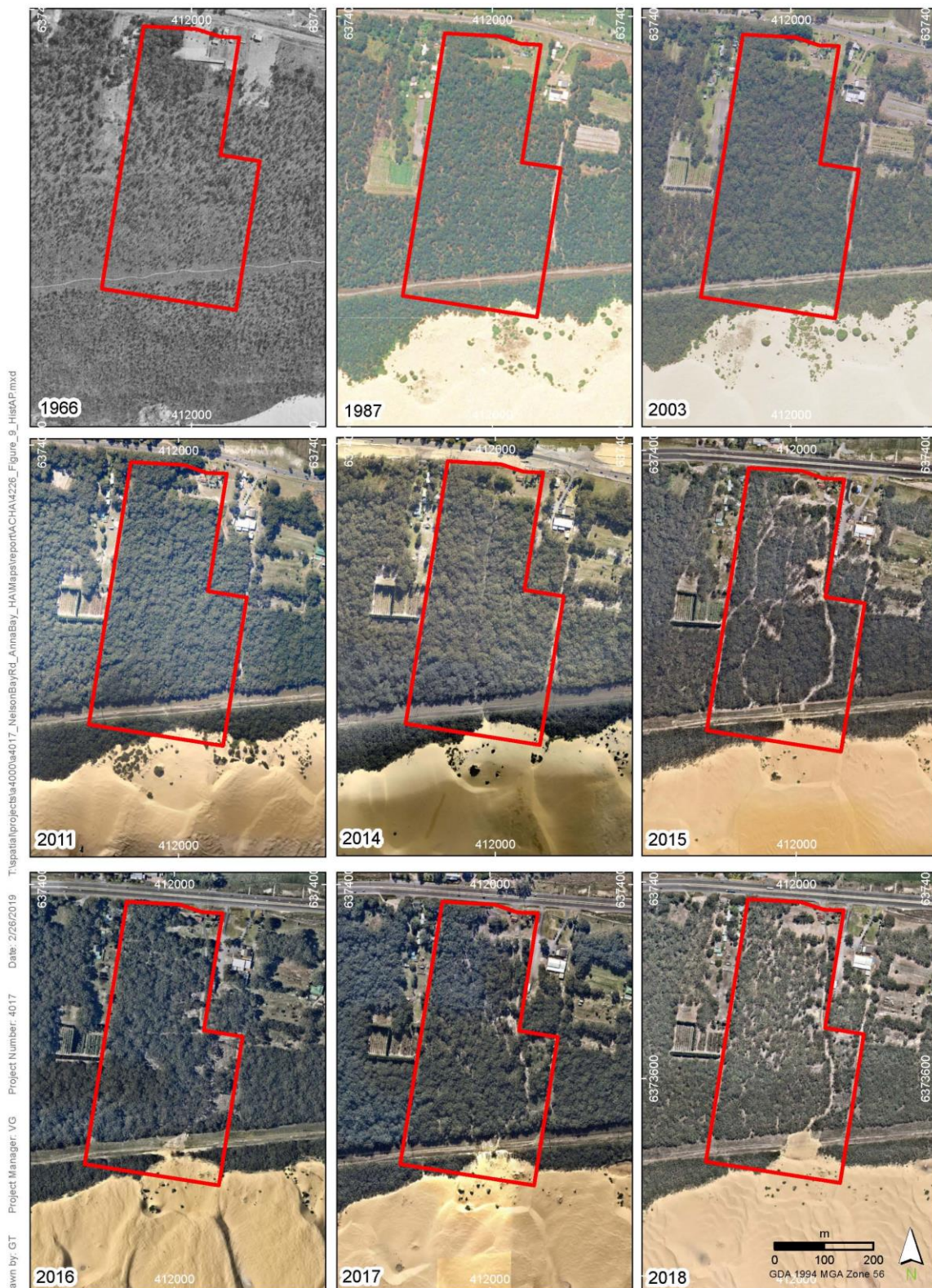


Figure 2-2: Deposited Plan 1191380





Suburb: Anna Bay, LGA: Port Stephens Council, Parish: Tomaree

niche
Environment and Heritage

Historical aerial photographs

4226 Nelson Bay Rd, Anna Bay, Sand Quarry – ACHA

FIGURE 9

Imagery: (c) LPI 1966-2009, NearMap 2010-2018

Figure 2-3: Depiction of Historical Wind-Blown Sand Incursion Over Time (1966-2018)



Plate 2-1: Site Access Location: View East along Nelson Bay Road



Plate 2-2: Site Access: View South into the Site at Intersection with Nelson Bay Road



Plate 2-3: Existing Site Access and Vegetation: View South



Plate 2-4: Existing Site Access: Approaching 33kV Electricity Easement from North



Plate 2-5: View North-West from Distant Sand Dunes: 33kV Electricity Network in Background



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Plate 2-7: View South-East from Easement - Part of Wind-Blown Sand Incursion and Associated Vegetation Destruction



Plate 2-8: View South-West from Easement - Part of Wind-Blown Sand Incursion and Associated Vegetation Destruction



Plate 2-9: View from Top of Wind-Blown Sand Dune Incursion - View South-West and Showing Associated Vegetation Destruction



Plate 2-10: View East Along Electricity Easement Following Emergency Removal of Sand Incursion Under Easement



Plate 2-11: View South - West through Electricity Easement Following Emergency Removal of Sand Incursion Under Easement

3 PROJECT DESCRIPTION

The proposed development incorporates the following:

- Hay Enterprises (NSW) Pty. Ltd. proposes to establish a sand extraction facility on Lot 591 in DP 1191380, 4226 Nelson Bay Road, Anna Bay. The construction of a Site Office and Manager's Residence is also proposed at the site.
- The sand extraction operations seek to remove wind deposited sand to natural ground level within an existing 33kV electrical easement and also immediately south of this easement. The proposal seeks to extract a maximum 50,000 cubic metres of sand per year for a period of up to 30 years.
- The sand resource is intended for general construction and filling purposes in various locations. Product will be classified as VENM (Virgin Excavated Natural Material) and utilised for bulk filling of land and developments.
- Sand will be loaded via a front-end loader into haulage trucks and removed from the site to market destinations via Nelson Bay Road.
- 6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months.
- 6 part-time employee positions will be required for internal road construction purposes for 2 months.
- 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site.

Figures 3-1 to 3-4 show details of the proposed development of the land.



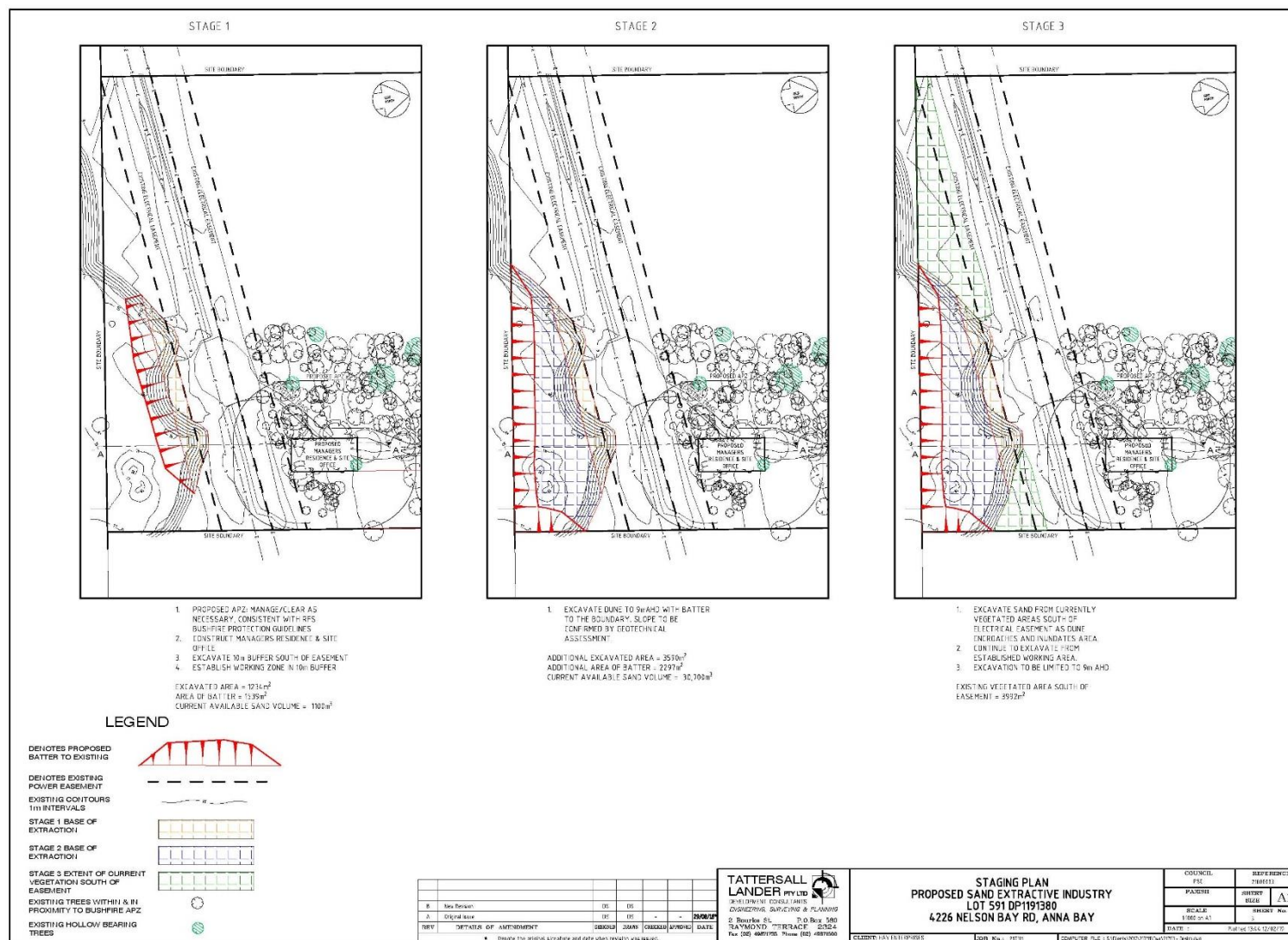


Figure 3-2: Proposed Development Staging

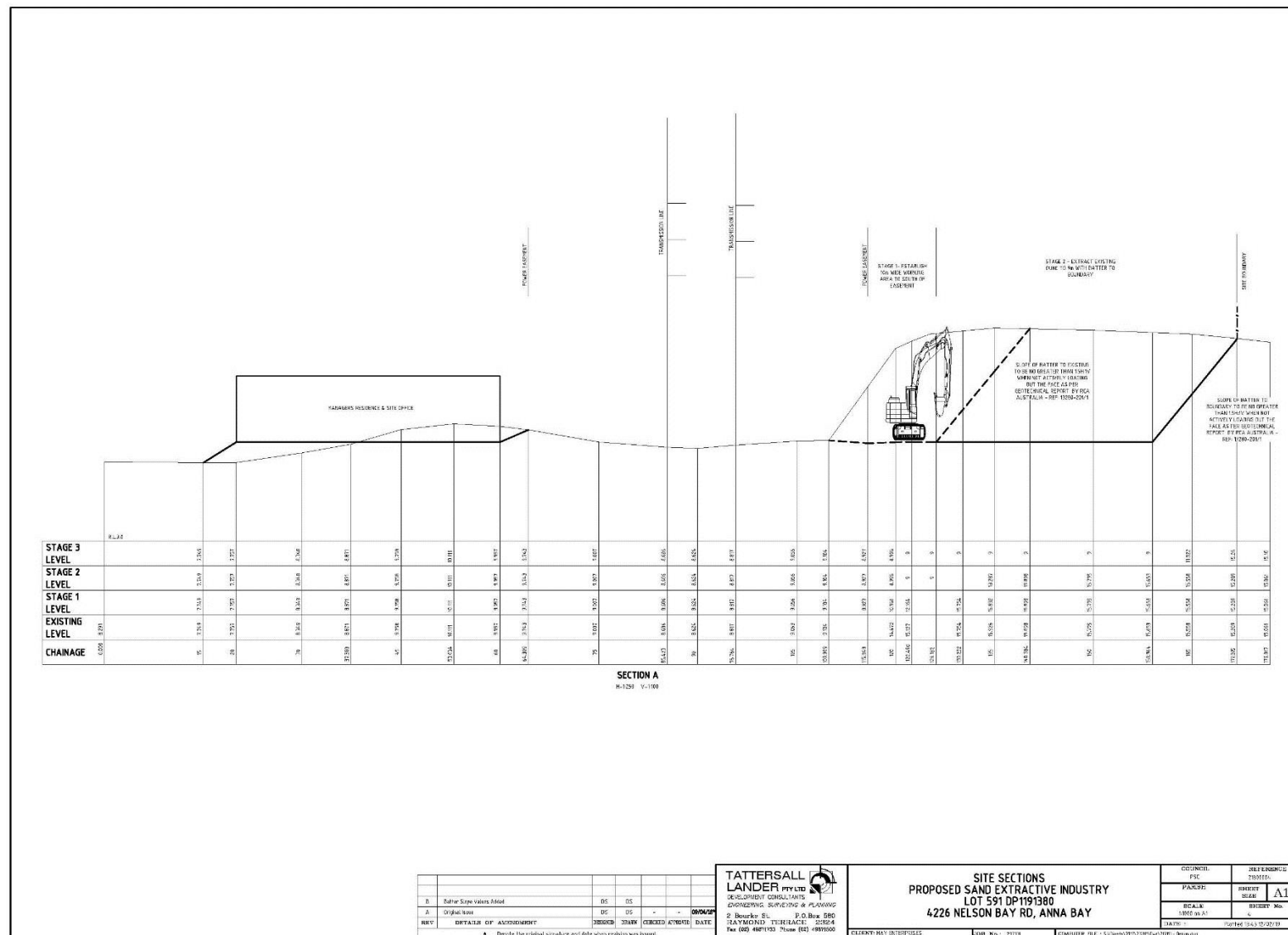


Figure 3-3: Site Sections

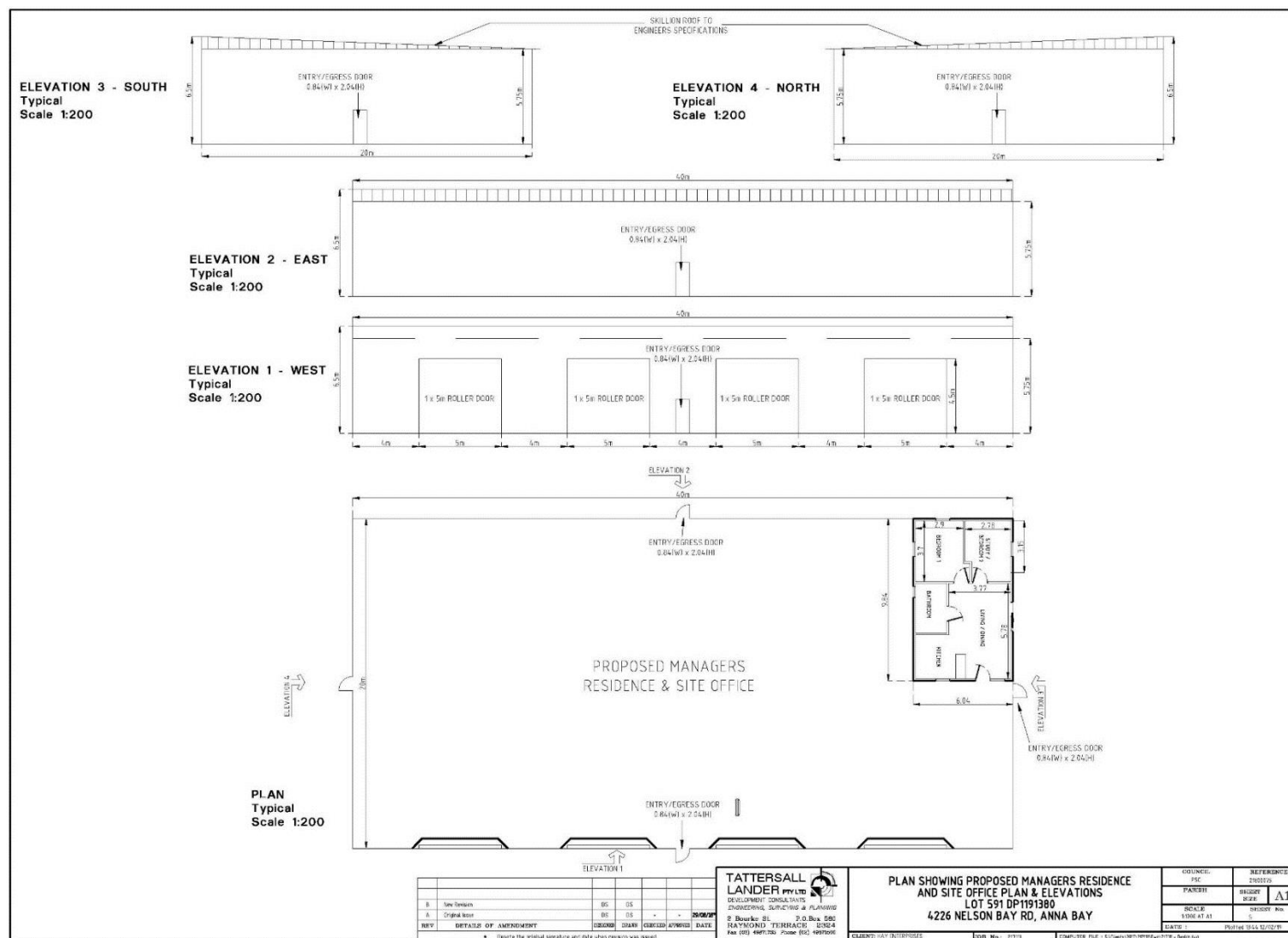


Figure 3-4: Floor Plans & Elevations: Site Office and Manager's Residence

4 STAKEHOLDERS

For the purposes of the SIA, the following are considered stakeholders:

- Anna Bay Community
- Relevant Aboriginal individuals, communities and associations including Registered Aboriginal Parties
- Ausgrid
- Port Stephens Council
- Local Businesses
- Relevant statutory and non-statutory agencies

With any commencement of on-site operations, the stakeholder group will be expanded to include:

- Company employees
- Company Management
- Shareholders, if appropriate.

The details of consultation with stakeholders and associated social impact assessment is documented throughout this report.

5 WHAT ARE SOCIAL IMPACTS?

The Department of Planning & Environment Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development (2017) describes social impacts associated with extractive industries.

Whilst the proposed development is not of state significant nature, the guideline provides useful information for the purposes of social impact assessment for extractive industries and has been utilised in that way in a broad sense.

The guideline stipulates that social impacts can involve changes to people's:

- **way of life**, including:
 - o how people live, for example, how they get around, access to adequate housing
 - o how people work, for example, access to adequate employment, working conditions and/or practices
 - o how people play, for example, access to recreation activities
 - o how people interact with one another on a daily basis
- **community**, including its composition, cohesion, character, how it functions and sense of place
- **access to and use of infrastructure, services and facilities**, whether provided by local, state, or federal governments, or by for-profit or not-for-profit organisations or volunteer groups
- **culture**, including shared beliefs, customs, values and stories, and connections to land, places, and buildings (including Aboriginal culture and connection to country)
- **health and wellbeing**, including physical and mental health
- **surroundings**, including access to and use of ecosystem services, public safety and security, access to and use of the natural and built environment, and its aesthetic value and/or amenity
- **personal and property rights**, including whether their economic livelihoods are affected, and whether they experience personal disadvantage or have their civil liberties affected
- **decision-making systems**, particularly the extent to which they can have a say in decisions that affect their lives, and have access to complaint, remedy and grievance mechanisms
- **fears and aspirations** related to one or a combination of the above, or about the future of their community

As cited by the Department of Planning & Environment Social Impact Assessment Guideline for State Significant Mining, Petroleum Production and Extractive Industry Development (2017), social impacts vary in their nature, and can be:

- Positive (e.g. increased employment opportunities) or negative (e.g. increase in prevalence in certain health conditions);
- Tangible (e.g. availability of affordable housing) or intangible (e.g. social cohesion);
- Direct (i.e. caused by the project) or indirect (i.e. caused by a change that is caused by the project) and can also be cumulative (spatial, temporal or linked);
- Directly quantifiable, indirectly or partly quantifiable or only able to be described and assessed in qualitative terms;
- Experienced differently by different people and groups within a community, by different communities and different times and stages of a particular project; and
- Perceived.

Factors that may influence the nature and scale of the social impacts associated with resource projects include its:

- Location and associated proximity to population;
- Extraction methodology;
- Local and regional context; and
- Commodity cycle prices.

6 COMMUNITY ENGAGEMENT AND SIA PREPARATION: OBJECTIVES, SCOPE & METHODOLOGY

6.1 Overview

The SEARs require that the EIS must:

- Provide an economic assessment of the likely social and economic impacts of the development, including consideration of both the significance of the resource and the costs and benefits of the project

Extensive, early community engagement has been undertaken and the needs and concerns of the community have been recorded and specifically addressed within the preparation of the EIS and the relevant specialist reports that accompany it. Consultation has occurred with those stakeholders identified in **Section 4** of this report.

The SIA specifically addresses the considerations raised by the community as well as detailing the wider social impacts of the proposed development on the general community.

The EIS supports effective integration between social, economic and environmental considerations.

6.2 Engagement Objectives

Key engagement objectives for the SIA have included:

- Ensuring potentially affected people, groups, organisations and the community are identified and having a sufficient understanding of the proposed project; how it may -and how SIA contributes to that process; and how they can participate and be informed and consulted;
- Collecting qualitative and quantitative data, evidence and insights for scoping the SIA and preparing the SIA component of the EIS, in ways that maximise diversity and representativeness;
- Understanding the interests that potentially affected and interested people have in the project; and how potential impacts are predicted to be experienced from their perspectives;
- Considering the views of potentially affected and interested people in a meaningful way, and, using these insights to inform project planning and design, mitigation and enhancement measures, and monitoring and management frameworks;
- Confirming data, assumptions, findings and recommendations;
- Ensuring people know how their input and views have been taken into account;

- Helping people to understand how other specialist studies prepared for the EIS (for example, air quality, noise) and any associated proposed mitigation measures, address social impact; and
- Respecting people's privacy, allowing them to communicate their views anonymously if they desire.

6.3 Stakeholder Engagement

Making decisions on person(s) with which to engage depends on the project context and linkages and networks that connect them to the project.

Those stakeholders who have been engaged for the purposes of consultation and associated discernment of social impacts are outlined under **Section 4** of this report.

6.4 Social Impact Engagement Methodology

Social Impact Assessment is an approach to predicting and assessing the likely consequences of a proposed action in social terms, and developing options and opportunities to improve social outcomes. Best practice SIA is participatory, and involves understanding impacts from the perspectives of those involved in a personal, community, social or cultural sense to provide a complete picture of potential impacts, their context and meaning.

As is the case with any type of change, some individuals or groups within a community may benefit, whilst others may experience negative impacts due to a development proposal. "Impacts" may be positive or negative in a social, cultural or community sense. If negative impacts are predicted, it is the role of the SIA to determine how such impacts may be managed effectively to reduce the degree of impact to those affected.

A number of methodologies/techniques were used to collect information for this SIA. Methodologies/techniques were largely reliant upon stakeholder type, initial perception and extent of impact type and stakeholder address/location.

The levels and techniques required for social impact assessment depend on the following:

- Scale of the project's area of social influence.



- Degree of diversity among potentially affected and interested people and the extent to which they are expected to be affected or interested.
- Range and types of impacts involved and their relative importance.
- Timing and context, noting that stakeholders and their interests can change with project stages and phases of the environmental impact assessment and social impact assessment.
- Needs of different audiences (for example, cultural appropriateness, capacity to participate, communication styles and/or preference, barriers to participation) including: Aboriginal people; younger and older people, people with disability; people from culturally and linguistically diverse communities; people who are vulnerable, socio-economically disadvantaged or otherwise marginalised; and any other 'difficult-to-reach' groups; and
- Opportunities to rely on or integrate with other engagement activities planned for the environmental impact assessment to avoid duplication and manage 'consultation fatigue'.

The SIA process from the scoping of relevant factors, through community profiling and consideration of potential impacts to the development of mitigation or enhancement strategies and processes of monitoring and evaluation is presented in

Figure 6-1 The activities comprising SIA from Vanclay (2003) have been summarised into the five stages within **Figure 6-1**.



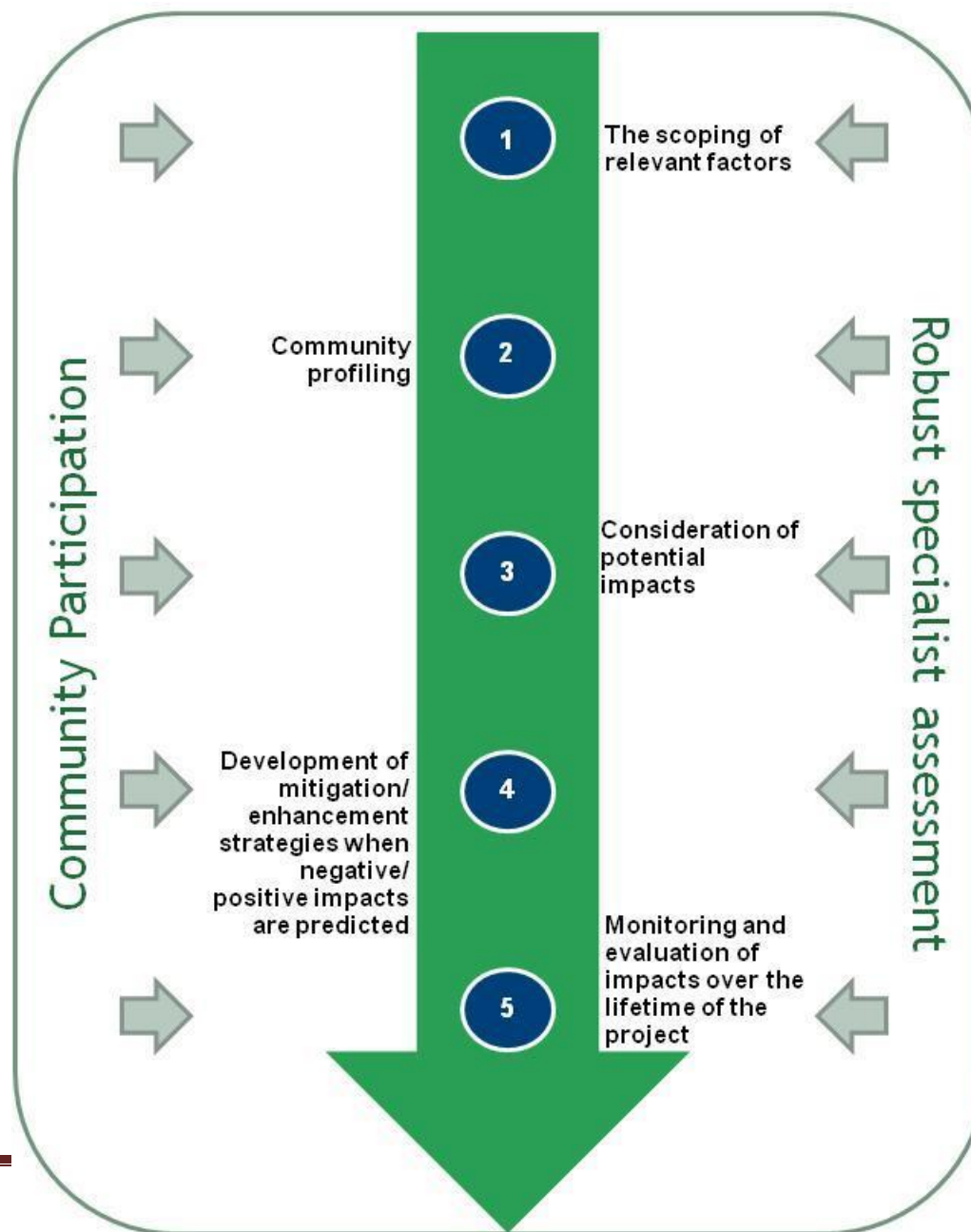


Figure 6-1: Social Impact Assessment Methodology: Vanclay (2003)

6.5 Key Activities: Social Impact Engagement Methodology

A number of specific key activities were undertaken to inform this SIA, including community consultation and engagement, analysis of key demographics and an analysis of related media (see **Table 6-1**).

Table 6-1: SIA Methodologies and Detail

SIA Methodology Type	SIA Methodology Detail
Community Meeting	A public meeting was facilitated by Tattersall Lander on 12 September, 2018, to discuss the development proposal. 21 residents/stakeholders recorded their attendance at the community meeting held at Anna Bay/Birubi Point Community Hall on 12 September, 2018 (see further detail in Section 8).
Community Information Sheets	Information sheets outlining the proposed development of the land and associated activities were made available at the community meeting for any interested parties.
Social Indicator Analysis	Examination of census data and associated community data sets (specifically created from analysis of census data) to develop a snapshot profile of the Anna Bay community.
Document Analysis	Collation, examination and review of relevant reports and studies relating to the assessment area, including demographic profiling.
Media Review	Review of local media to identify community issues associated with the proposed development of the land.
Preliminary Communication with Statutory and Non-Statutory Agencies	To the extent as required and specified in writing by the SEARs, and initially and specifically to inform the detailed content of the EIS, the following parties have been consulted: • Anna Bay Community • Relevant Aboriginal individuals, communities and associations, including Registered Aboriginal Parties • Ausgrid



	• Port Stephens Council • Office of Environment and Heritage • Environment Protection Authority • Department of Primary Industries (Water Roads and Maritime Services • NSW Rural Fire Service • Hunter Local Land Services • Hunter Water Government agencies have advised that they will each provide any additional comments and requirements once the Development Application and EIS have been provided to them.
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7 ANNA BAY: LOCATIONAL AND DEMOGRAPHIC PROFILE

7.1 Anna Bay Locational Context and Local Government Characteristics

As previously detailed, the proposed sand extraction site development site is located on the southern side of Nelson Bay Road at Anna Bay.

Anna Bay is the name of a suburb, a town and a bay in the Port Stephens local government area; situated between Newcastle and Nelson Bay. The suburb and town are immediately adjacent to the north-eastern end of Stockton Beach and the town provides one of the major entry points to the beach. The locality provides beaches and tourism in association with residential, commercial and rural uses.

Port Stephens LEP 2013 is the principal local environmental planning instrument governing land use in the Port Stephens LGA. LEP 2013 zones the proposed development site as RU2 Rural Landscape. **Figure 7-1: Port Stephens LEP 2013 Zoning Map**

identifies the site in relation to the zoning of the land.

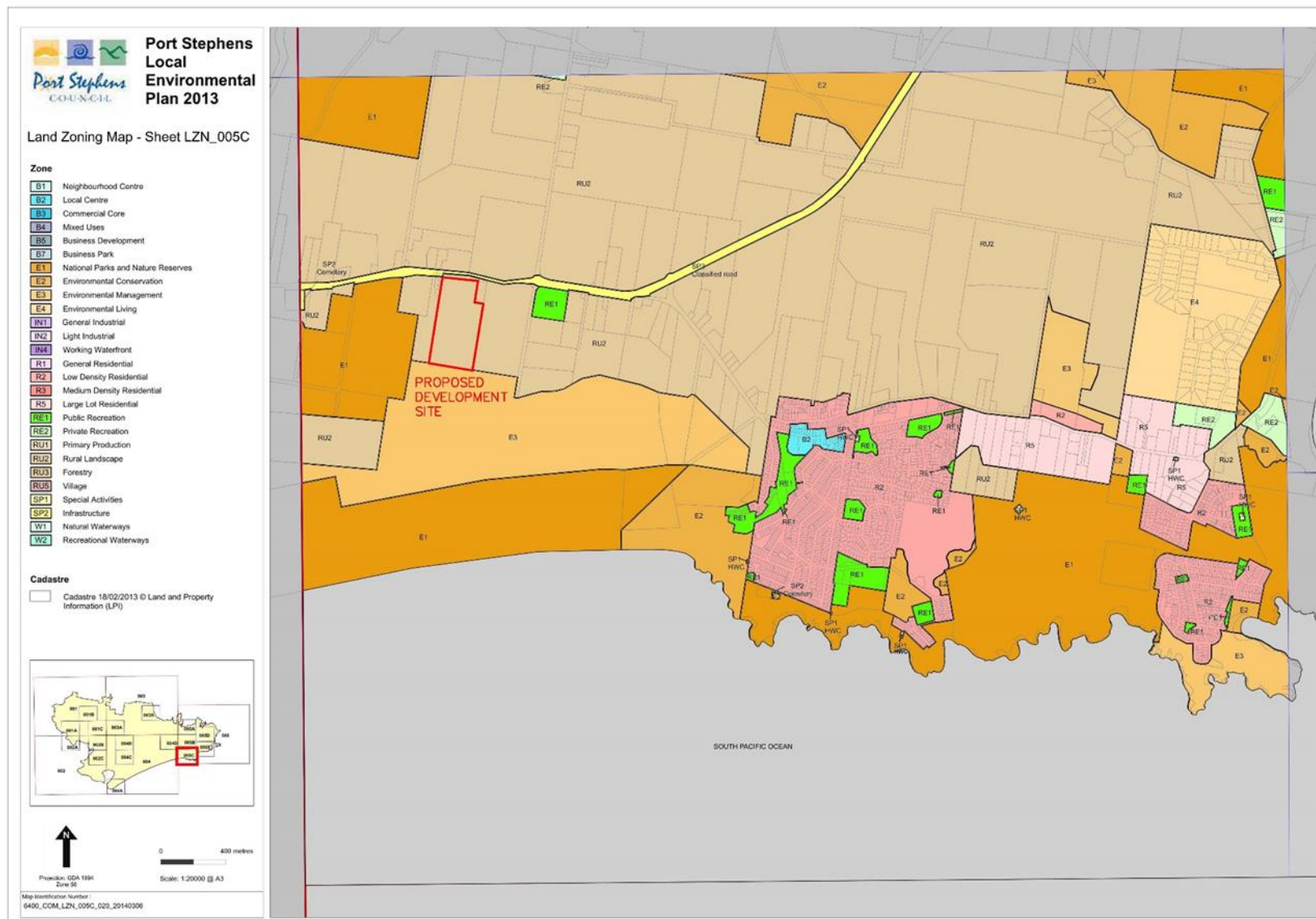
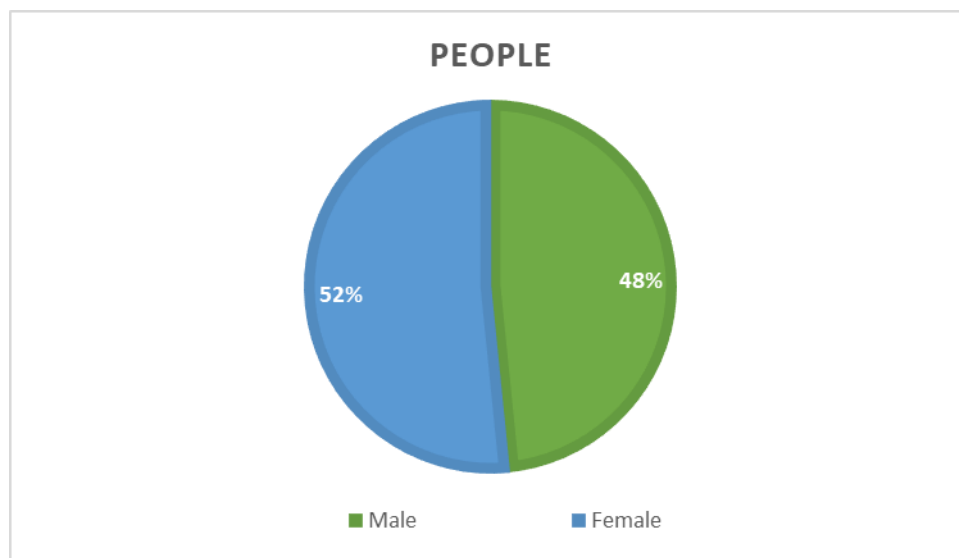


Figure 7-1: Port Stephens LEP 2013 Zoning Map

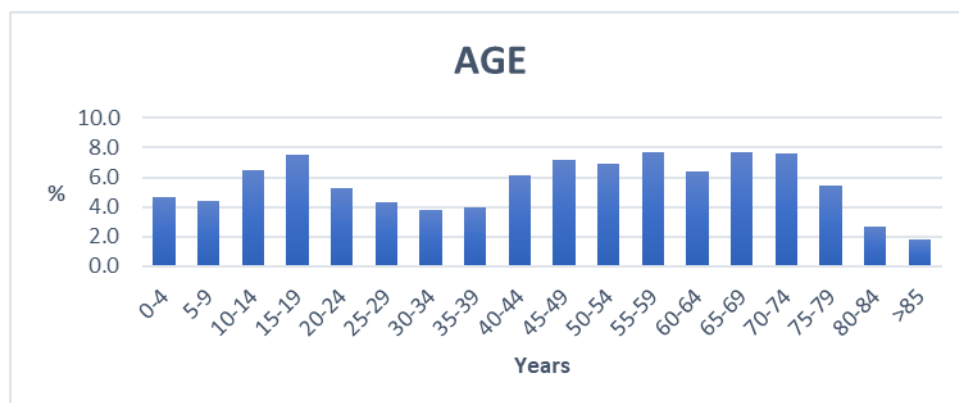
7.2 Anna Bay Demography and Context

A full breakdown and analysis of the demographic characteristics of Anna Bay residents and the comparative relationship with the Port Stephens LGA, New South Wales and Australia is located at **Appendix 1**. A 'snapshot' of the more pertinent characteristics which relate to the SIA is provided below.



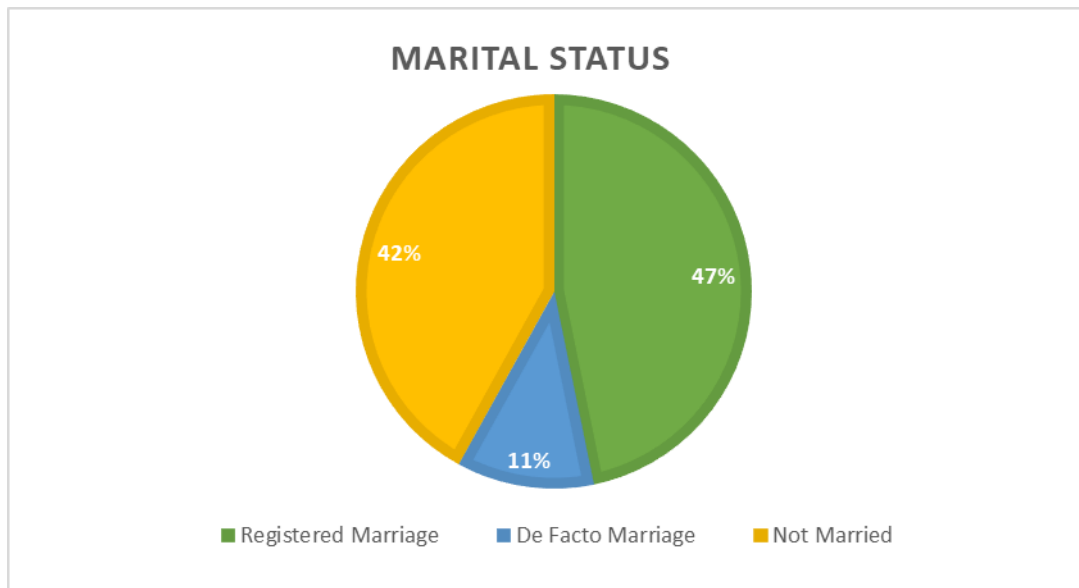
Source: Census Statistics SnapShot, ABS 2016

Figure 7-2: Anna Bay Community 2016 - People



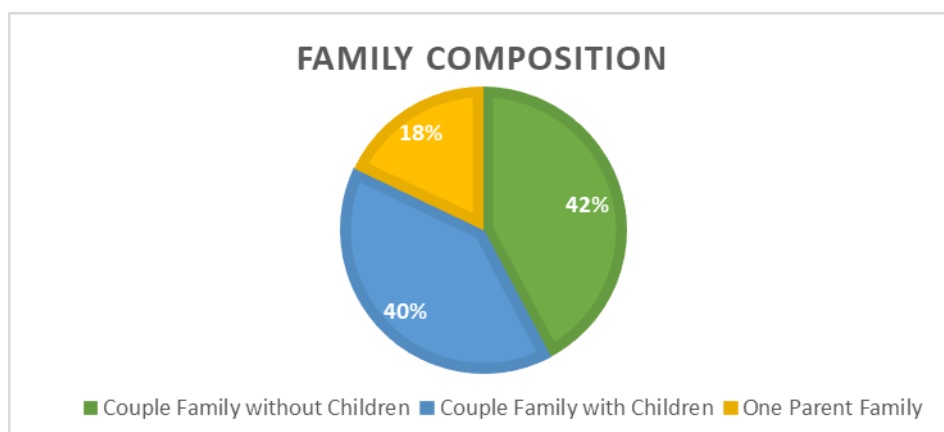
Source: Census Statistics SnapShot, ABS 2016

Figure 7-3: Anna Bay Community 2016 - Age



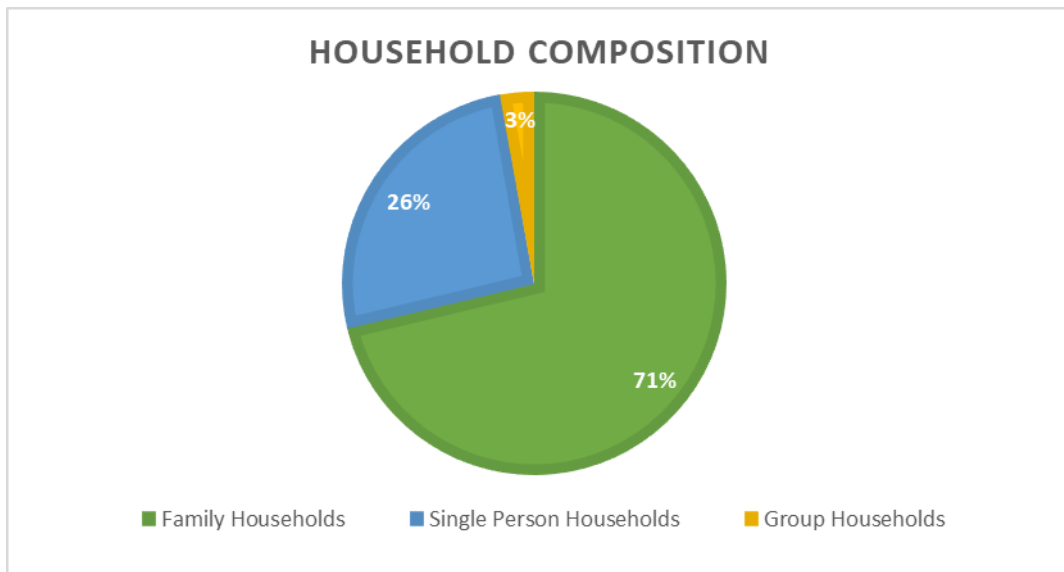
Source: Census Statistics SnapShot, ABS 2016

Figure 7-4: Anna Bay Community 2016 - Marital Status



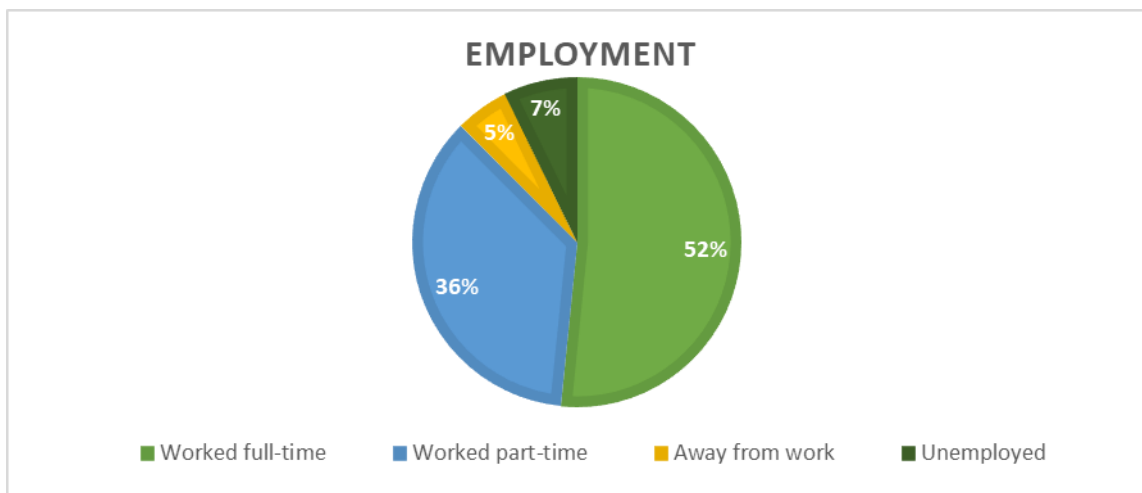
Source: Census Statistics SnapShot, ABS 2016

Figure 7-5: Anna Bay Community 2016 - Family Composition



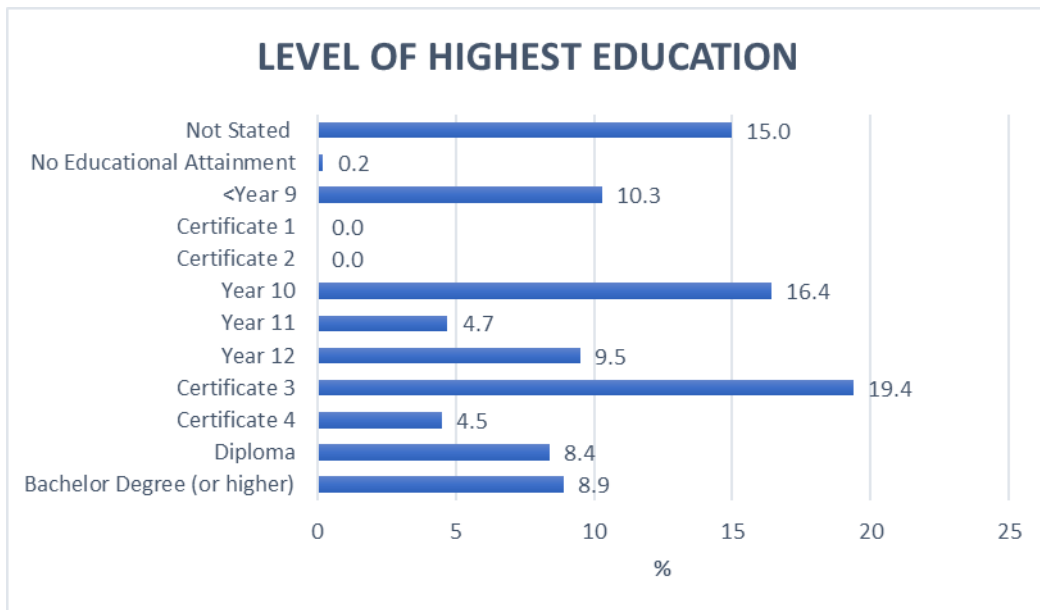
Source: Census Statistics SnapShot, ABS 2016

Figure 7-6: Anna Bay Community 2016 - Household Composition



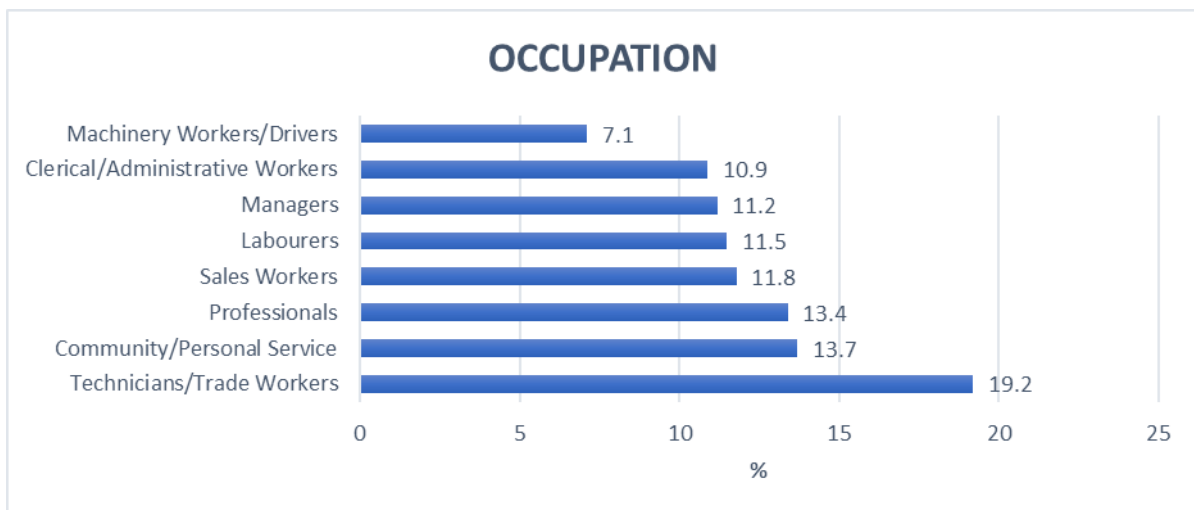
Source: Census Statistics SnapShot, ABS 2016

Figure 7-7: Anna Bay Community 2016 - Employment



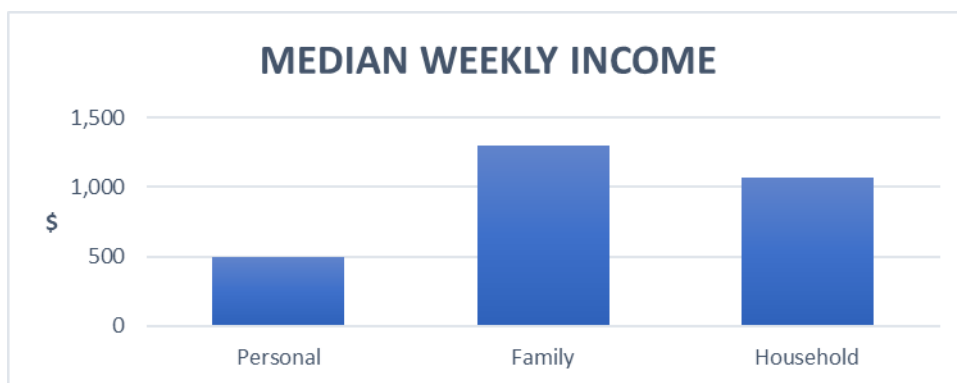
Source: Census Statistics SnapShot, ABS 2016

Figure 7-8: Anna Bay Community 2016 - Level of Highest Education



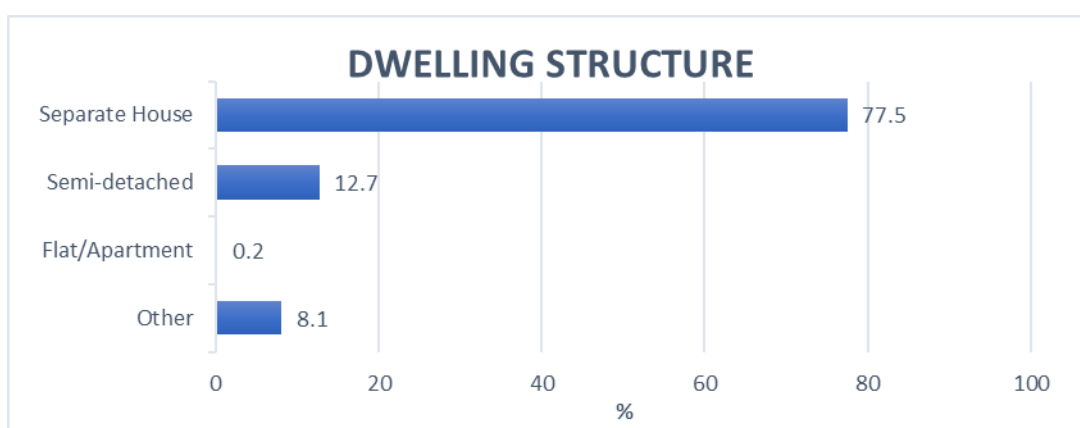
Source: Census Statistics SnapShot, ABS 2016

Figure 7-9: Anna Bay Community 2016 – Occupation



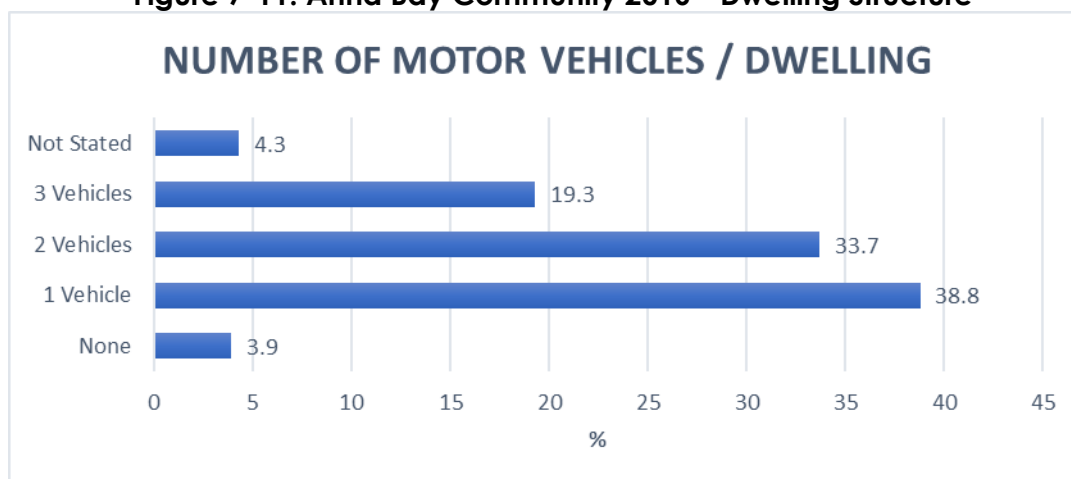
Source: Census Statistics SnapShot, ABS 2016

Figure 7-10: Anna Bay Community 2016 - Median Weekly Income



Source: Census Statistics SnapShot, ABS 2016

Figure 7-11: Anna Bay Community 2016 - Dwelling Structure



Source: Census Statistics SnapShot, ABS 2016

Figure 7-12: Anna Bay Community 2016 - Number of Motor Vehicles / Dwelling

There are no specific elements of the Anna Bay demographic profile which warrant particular consideration in the SIA having regard to the proposed development.

8 PUBLIC MEETING 12 SEPTEMBER, 2018

A Public Meeting (facilitated by Tattersall Lander) was convened to discuss the development proposal. Stakeholders were advised by Public Notice of the intention to hold the Public Meeting. Public Notice was given by way of advertisement in the Public Notes section of the Port Stephens Examiner; the date of publication being 6 September, 2018. A copy of the publication is provided at **Appendix 2**. Details of the public meeting were also circulated to the community via advertisement at both the Anna Bay Post Office and Anna Bay Primary School.

+



Plate 8-1: Director Tattersall Lander (Bob Lander) during presentation to the Public Meeting on 12 September, 2018

21 residents/stakeholders recorded their attendance at the community meeting held at the Anna Bay/Birubi Point Community Hall on 12 September, 2018.

Locational representation of public meeting attendees, including business owners, features below. On occasion, there were multiple attendees from the same address.

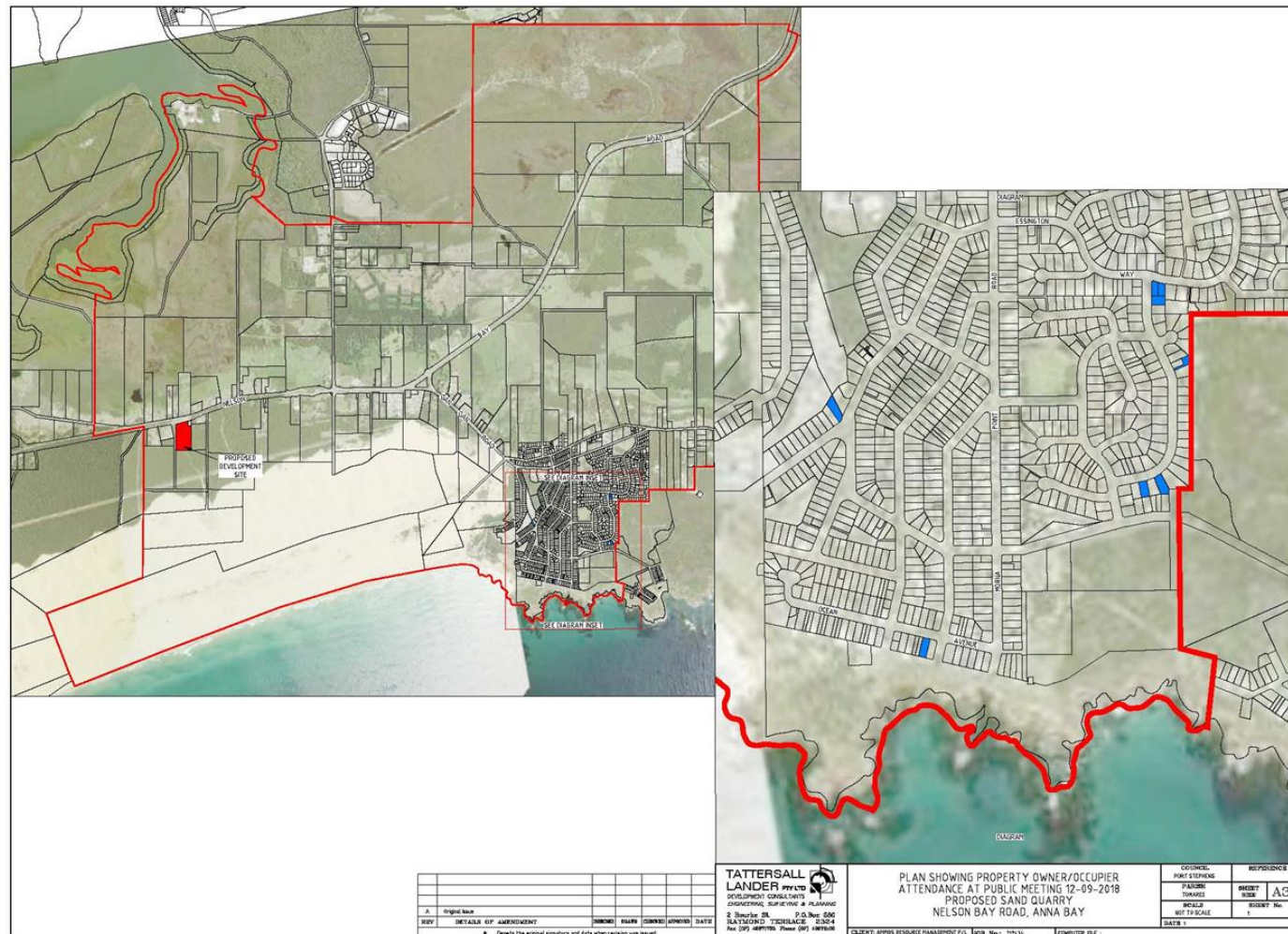


Figure 8-1: Addresses of Recorded Attendees at Public Meeting 12 September, 2018 Locational Relationship to Proposed Development Site

Suburb/Township	Number of Attendees
Nelson Bay	1
Bobs Farm	5
Shoal Bay	1
Address Not Given	1

Table 8-1: Recorded Attendees not from Anna Bay

A full copy of the public presentation given by Tattersall Lander at the Public Meeting is included at **Appendix 2**.

9 REVIEW AND ANALYSIS OF LOCAL MEDIA

9.1 Port Stephens Examiner

Article 20 September, 2018

Title: Residents Turn Out to Meeting to Hear Proposal (sic) Mine

Summary: Discusses local resident attendance (reported around 20 attendees) at the public meeting at Bobs Farm Community Hall, facilitated by Tattersall Lander on 12 September, 2018 to illustrate the detail of the proposed sand mine development and to seek community comment.

(Note: See **Appendix 3** for full article)

10 ASSESSMENT OF SOCIAL IMPACTS RAISED BY SPECIFIED STAKEHOLDERS

10.1 Matters Raised at the Public Meeting 12 September, 2018

Questions and comments raised by attendees at the Public Meeting held on 12 September, 2018 are summarised (in descending order of the number of times raised by meeting participants; with number of times raised indicated) as follows:

Table 10-1: Matters Raised by Public Participants at Public Meeting 12 September, 2018

Public Meeting Commentary	No. of Times Raised
Proposed development details including frequency of trucks and sand removal	17
Sand: resource detail and markets	11
Strategic relationship between sand movement to the site and the wider locality including Stockton Beach and Newcastle: potential to halt sand loss from sand source areas to this site and to others in the vicinity	7
Project relationship between applicant/landowner/Ausgrid	6
Details of sand already removed for Ausgrid easement maintenance purposes	6
Ability for other existing mines in the locality to remove the sand rather than creating a new facility	4
Responsibility for project monitoring	3
Impact on existing road infrastructure	2
Responsibility for preparation of expert reports which inform the EIS	2
Applicant company characteristics	1
Owner company characteristics and land ownership	1
Involvement of State Government	1
Lead time for EIS preparation and lodgement	1
Requirement for Species Impact Statement?	1
Site development context	1
Potential to reintroduce the sand to Stockton Beach	1
Processes involved for additional site mining beyond that proposed	1
Setting precedent for more mines – this is the only location where sand break to easement has occurred	1
Relationship between proposed development and the water table	1
Visual impacts from sand dunes to the south which are currently the subject of tourist activity	1
Potential use of vegetation to slow down movement of windblown sand	1
Removal of existing vegetation by NPWS and creation of associated issues	1
Ongoing dune stability	1



10.2 Matters Raised by Statutory Authorities

Consulted government agencies have advised that they will each provide their (further) comments and requirements once the Development Application and EIS have been reviewed. The extent to which matters raised by those agencies are currently known is limited to information provided with the SEARs. SEARs are discussed in the detail of the EIS prepared by Tattersall Lander.

11 RESPONSE TO MATTERS RAISED AT THE PUBLIC MEETING, 12 SEPTEMBER, 2018

11.1 Overview

Due to the limited physical nature of the proposed development (including requirements to remove sand under the electricity easement for Ausgrid maintenance purposes), the primary nature of discussion by public meeting participants was centred on questions and comments rather than commentary by way of specific objection due to perception of adverse impacts.

Matters raised at the public meeting are responded to below. Responses provided below were also made available to meeting participants during the course of the public meeting.

Impacts of the proposed development and associated amelioration strategies are discussed in the detail of the EIS prepared by Tattersall Lander Pty. Ltd.

11.2 Proposed Development Details Including Frequency of Trucks and Sand Removal

- Sand will be removed to a maximum of 50,000 cubic metres per annum at intervals where wind-blown sand provides potential incursion and maintenance issues to Ausgrid power lines. This will occur on an as needs basis for easement availability purposes.
- The project is proposed to have a life of up to 30 years.
- Sand will be loaded via a front-end loader into haulage trucks and removed from the site to market destinations; primarily Newcastle and the Hunter Valley.
- Sand will be removed to ground level only.
- A maximum of 40 heavy vehicle trips per day will remove sand during a peak time.
- 6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months.
- 6 part-time employee positions will be required for internal road construction purposes for 2 months.
- 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site.
- The grade at which the sand dune is proposed to be modified under different circumstances is as follows: (1) When the sand mine is not actively loading out, the face should be battered down to an angle of no greater than 1.5H:1V; and (2) From a geotechnical perspective a maximum batter slope of 2H:1V be adopted for the final landform batter.



11.3 Sand: Resource Detail and Markets

- Existing dunes are approximately 13 metres high (electricity cables which are part of the 33KV line are approximately 9 metres in height).
- The sand resource is intended for general construction and filling purposes in various locations. Product will be classified as VENM (Virgin Excavated Natural Material) and would be used for bulk filling of land and developments.
- As previously detailed, sand markets are primarily those within Newcastle and the Hunter Valley.

11.4 Strategic Relationship Between Sand Movement to the Site and the Wider Locality Including Stockton Beach and Newcastle: Potential to Halt Sand Loss from Sand Source Areas to this Site and to Others in the Vicinity

- Not the focus of this application: strategic direction required by others.

11.5 Details of Sand Already Removed for Ausgrid Easement Maintenance Purposes

- 10,000 tonnes of sand was removed within 8 days as a critical emergency measure due to potential electrical arcing between the sand and electricity cables.

11.6 Ability for Other Existing Sand Mines in the Locality to Remove the Sand Rather than Creating a New Facility

- Land owner has existing commercial interests with Hay Enterprises Pty. Ltd. to remove sand from the property

11.7 Responsibility for Project Monitoring

- Tattersall Lander Pty. Ltd.
- Hay Enterprises Pty. Ltd.
- Ausgrid
- Environment Protection Authority (the proposed development is integrated development pursuant to section 4.46 of the *Environmental Planning & Assessment Act 1979*: the development constitutes a scheduled activity (extractive industry) pursuant to the *Protection of the Environment Operations Act 1997* requiring an Environment Protection Licence (EPL) pursuant to sections 43(b), 48 and 55).

11.8 Impact on Existing Road Infrastructure

- Limited: see Traffic Impact Assessment in the EIS.

11.9 Responsibility for Preparation of Expert Reports Which Inform the EIS

- Tattersall Lander Pty. Ltd. as well as various specialist consultants sourced by Tattersall Lander Pty. Ltd.

11.10 Applicant Company Characteristics

- Tattersall Lander Pty. Ltd., Development Consultants

11.11 Owner Company Characteristics and Land Ownership

- Ragusa Pty. Ltd.

11.12 Involvement of State Government in Resource Extraction

- Nil

11.13 Lead time for EIS Preparation and Lodgement

- The Public Meeting was advised around 3 months pending completion of Aboriginal Cultural Heritage Assessment. An Aboriginal Heritage Impact Permit (AHIP) is required which requires a likely EIS lodgement during October, 2019.

11.14 Requirement for Species Impact Statement?

- None required as demonstrated by Wildthing Environmental Consultants in their ecological assessment.

11.15 Site Development Context

- Part of the Port Stephens LGA.
- Several additional sand mines operating in the vicinity (see detail in EIS).
- Wind-blown sand creating maintenance issues for Ausgrid easement.

11.16 Potential to Reintroduce the Sand to Stockton Beach

- Not the focus of this application

11.17 Processes Involved for Additional Site Mining Beyond that Proposed

- None proposed. Should further development be proposed, it would be subject to the provisions of relevant legislation at the time of any further proposal.

11.18 Setting Precedent for More Mines – This is the Only Location Where Sand Break to Easement has Occurred

- For the purposes of sand removal under the easement, any further sand incursion in other locations will need to be addressed on a merits-basis.

11.19 Relationship Between Proposed Development and the Water Table

- Sand will be removed to ground level only. Sand will not be removed below this level. Ground level at the electricity easement is 9m AHD. The proposed sand extraction seeks to remove wind deposited sand at or above ground level. The construction of the proposed Site Office and Manager's Residence will also occur at ground level.

The groundwater present beneath the site forms part of the Stockton Groundwater Resource and falls under the Water Sharing Plan for the North Coast Coastal Sands Groundwater Sources. Groundwater was encountered at a depth of approximately 2m AHD. Based on long term monitoring in nearby monitoring wells and published information, it is considered that the level of the groundwater surface may rise up to 2.8m below the base of the proposed sand extraction during wet climatic periods.

The proposal development will not directly impact groundwater.

11.20 Visual Impacts from Sand Dunes to the South Which are Currently the Subject of Tourist Activity

- A Visual Impact Assessment forms part of the EIS prepared by Tattersall Lander Pty. Ltd. Refer to that assessment as an expert assessment.

11.21 Potential Use of Vegetation to Slow Down Movement of Windblown Sand

- Existing substantial vegetation has been encumbered, buried and subsequently killed by wind-blown sand (see details, including photographs in this report and in the EIS). Revegetation options to stabilise sand in this location are limited because of this.

11.22 Removal of Existing Vegetation on Dunes in the Locality by NPWS and Creation of Associated Issues

- Noted

11.23 Ongoing Dune Stability

- The grade at which the sand dune is proposed to be modified under different circumstances is as follows: (1) When the sand mine is not actively loading out, the face should be battered down to an angle of no greater than 1.5H:1V; and (2) From a geotechnical perspective a maximum batter slope of 2H:1V be adopted for the final landform batter.

12 SOCIO-ECONOMIC IMPLICATIONS OF THE PROJECT

Sand from the proposed development site will be classified as VENM (Virgin Excavated Natural Material) and will be used for bulk filling of land and developments. The sand resource is intended for general construction and filling purposes in various locations; primarily Newcastle and the Hunter Valley.

The sand extraction will provide a cost-effective supply sand for the local and regional development industry.

The proposed operation will only source workers from the Port Stephens and local regional areas, so creating local sustainable jobs. The proposed sand mine provides an opportunity for local employment at Anna Bay and other local and regional businesses through the multiplier effect. The proposed sand extraction through the life of the mining operations will allow for the continued employment of local workers.

6 part-time employee positions will be required for construction of the Site Office and Manager's Residence for a period of 2 months. Similarly, 6 part-time employee positions will be required for internal road construction purposes for 2 months. 2 sand loading operators and 8-10 truck drivers will be required for sand removal and haulage during the time it is loaded and removed from the site. The proposed sand extraction facility will contribute to the up-skilling of the local workforce in training and development of staff.

The approval of the sand extraction operation will see jobs generated for up to 30 years.

Low volumes of sand are expected from this operation and will only be used for general construction and filling purposes. No specialist sand is available from this resource. At an advised rate of \$19 per cubic metre for the sand, the economic yearly potential based on a maximum of 50,000 cubic metres per annum is \$950,000.

13 MONITORING OF SOCIAL IMPACTS AND ONGOING COMMUNITY ENGAGEMENT

An important part of any social impact assessment relates to temporal and ongoing monitoring. Monitoring programs are useful in establishing not only project developments, but also community concerns and how such considerations may or may not align with actual risks or perceived impacts.

The following measures are credible methods of ongoing community engagement and could be encouraged in this particular circumstance, subject particularly, to community demand for same:

- Creation of a Community Consultative Committee
- Dedicated phone hot lines for regulation, compliance and emergency matters
- Community information sessions
- Annual community reports
- Annual dialogue with neighbours: formal and informal

14 CONCLUSION

The SIA has identified a range of stakeholder considerations associated with the proposal. Due to the limited physical nature of the proposed development (including requirements to remove sand under the electricity easement for Ausgrid maintenance purposes), the primary nature of discussion by the public has been centred on questions and comments rather than commentary by way of specific objection due to perception of adverse impacts.

Relevant community and technical mitigation strategies have been cited to address the variety of considerations which have been raised by both the public and by other stakeholders.

The EIS prepared for the proposed development incorporates a significant number of specific mitigation strategies in relation to the following considerations, as well as providing an associated Statement of Commitments:

- Traffic Impacts
- Ecological Impacts
- Noise and Vibration
- Air Quality
- Aboriginal Cultural Heritage

As is the case with many resource extraction projects, the perceived and experienced social impacts/ issues are often greatest for those living in closest proximity to the proposal, or those who perceive they will be most directly impacted by the development. Consequently, should the development application be approved, an appropriate social impact monitoring program should be developed to assess the degree to which impacts are occurring and appropriate methodologies by which to mitigate any impacts.

It will be vital for the proponent to maintain an ongoing dialogue with local residents throughout the operation of the sand mine in relation to issues of relevance and importance to the community.

The proposed sand extraction facility will provide a sand resource suitable for general purposes in the construction industry. Importantly, removal of windblown sand will also ensure that the 33KV electricity easement within the site is kept clear of sand and can be accessed for maintenance purposes.

Sand removal at the site will be initiated primarily by the need to remove sand for easement maintenance purposes. Whilst, because of this, the extraction rate will not necessarily reach its maximum threshold in any one year (50,000 cubic metres), the SIA and the associated EIS have each been prepared having regard to the impacts created at that level.

The project can be implemented with minimal adverse socio-economic and environmental impacts as demonstrated throughout this report and the associated EIS.

The project is justified on the basis of the efficient utilisation of available existing resources; maintenance of the existing electricity easement and overall economic benefits to local, regional and State economies.



References

(1) References

Australian Bureau of Statistics (2011) Australian 2011 Census
Australian Bureau of Statistics (2016) Australian 2016 Census
NSW Department of Planning & Environment (2017) Social Impact Assessment
Guideline for State Significant Mining, Petroleum Production and Extractive Industry
Development
Port Stephens Council (2018) Port Stephens Local Environmental Plan 2013
Tattersall Lander Pty. Ltd. (2019) Draft Environmental Impact Statement Anna Bay
Sand Mine
Vanclay (2003) International Principles for Social Impact Assessment

(2) References Specific to Media Articles

Port Stephens Examiner

Article: 20 September, 2018: 'Residents Turn Out to Meeting to Hear Proposal (sic) Mine'.

Appendix 1: Anna Bay Demographic Profile & Comparison to Port Stephens, NSW and Australia



People	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Male	1,857	48.4	35,289	49.4	3,686,014	49.3	11,546,638	49.3
Female	1,983	51.6	36,092	50.6	3,794,217	50.7	11,855,248	50.7
Aboriginal/Torres Strait Islander	109	2.8	3,448	4.8	216,176	2.9	649,171	2.8

Age	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Median Age	47		45		38		38	
0-4	177	4.6	3,806	5.3	465,135	6.2	1,464,779	6.3
5-9	167	4.4	4,400	6.2	478,184	6.4	1,502,646	6.4
10-14	250	6.5	4,350	6.1	443,009	5.9	1,397,183	6.0
15-19	286	7.5	4,200	5.9	448,425	6.0	1,421,595	6.1
20-24	202	5.3	3,561	5.0	489,673	6.5	1,566,793	6.7
25-29	163	4.3	3,266	4.6	527,161	7.0	1,664,602	7.1
30-34	147	3.8	3,335	4.7	540,360	7.2	1,703,847	7.3
35-39	155	4.0	3,549	5.0	499,724	6.7	1,561,679	6.7
40-44	234	6.1	4,334	6.1	503,169	6.7	1,583,257	6.8
45-49	276	7.2	4,459	6.2	492,440	6.6	1,581,455	6.8
50-54	265	6.9	5,002	7.0	485,546	6.5	1,523,551	6.5
55-59	297	7.7	5,002	7.0	469,726	6.3	1,454,332	6.2
60-64	244	6.4	5,078	7.1	420,044	5.6	1,299,397	5.6
65-69	297	7.7	5,468	7.7	384,470	5.1	1,188,999	5.1
70-74	291	7.6	4,588	6.4	292,556	3.9	887,716	3.8
75-79	208	5.4	3,141	4.4	217,308	2.9	652,657	2.8
80-84	104	2.7	1,988	2.8	155,806	2.1	460,549	2.0
>85	70	1.8	1,840	2.6	167,506	2.2	486,842	2.1

Social Marital Status	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Registered Marriage	1,272	46.8	25,956	50.9	2,612,630	48.3	8,001,141	47.7
De Facto Marriage	303	11.2	5,327	10.4	506,133	9.4	1,751,731	10.4
Not Married	1,141	42.0	19,703	38.6	2,290,887	42.3	7,024,973	41.9



Level of Highest Education	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Bachelor Degree (or higher)	290	8.9	6,470	11.0	1,424,716	23.4	4,181,406	22.0
Diploma	272	8.4	5,289	9.0	543,142	8.9	1,687,893	8.9
Certificate 4	146	4.5	2,352	4.0	167,947	2.8	551,767	2.9
Certificate 3	629	19.4	10,981	18.7	730,498	12.0	2,442,203	12.8
Year 12	308	9.5	6,232	10.6	930,654	15.3	2,994,097	15.7
Year 11	151	4.7	2,237	3.8	203,574	3.3	941,531	4.9
Year 10	532	16.4	9,743	16.6	702,178	11.5	2,054,331	10.8
Certificate 2	0	0.0	67	0.1	4,849	0.1	13,454	0.1
Certificate 1	0	0.0	3	0.0	625	0.0	2,176	0.0
<Year 9	333	10.3	6,109	10.4	513,209	8.4	1,529,897	8.0
No Educational Attainment	6	0.2	164	0.3	54,870	0.9	145,844	0.8
Not Stated	487	15.0	7,099	12.1	627,465	10.3	1,974,794	10.4

Employment	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Worked full-time	848	51.6	15,985	53.0	2,134,521	59.2	6,623,065	57.7
Worked part-time	591	35.9	10,281	34.1	1,071,151	29.7	3,491,503	30.4
Away from work	88	5.3	1,687	5.6	174,654	4.8	569,276	5.0
Unemployed	118	7.2	2,212	7.3	225,546	6.3	787,452	6.9

Occupation	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Technicians/Trade Workers	293	19.2	4,940	17.7	429,239	12.7	1,447,414	13.5
Community/Personal Service	209	13.7	3,562	12.7	350,261	10.4	1,157,003	10.8
Professionals	205	13.4	4,019	14.4	798,126	23.6	2,370,966	22.2
Sales Workers	180	11.8	2,905	10.4	311,414	9.2	1,000,955	9.4
Labourers	176	11.5	3,151	11.3	297,887	8.8	1,011,520	9.5
Managers	171	11.2	3,023	10.8	456,072	13.5	1,390,047	13.0
Clerical/Administrative Workers	166	10.9	3,601	12.9	467,977	13.8	1,449,681	13.6
Machinery Workers/Drivers	109	7.1	2,272	8.1	206,839	6.1	670,106	6.3

Median Weekly Incomes	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Personal	497		563		664		662	
Family	1,297		1,402		1,780		1,734	



Household	1,065		1,158		1,486		1,438	
Travel to Work	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Car (as driver)	1,089	71.1	19,643	70.3	1,953,399	57.8	6,574,571	61.5
Car (as passenger)	81	5.3	1,280	4.6	144,820	4.3	489,922	4.6
Worked at Home	61	4.0	1,367	4.9	163,026	4.8	503,582	4.7
Walked Only	51	3.4	731	2.6	130,957	3.9	370,427	3.5
Family Composition	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Couple Family without Children	414	41.9	8,804	45.3	709,524	36.6	2,291,987	37.8
Couple Family with Children	390	39.5	7,267	37.4	887,358	45.7	2,716,224	44.7
One Parent Family	176	17.8	3,167	16.3	310,906	16.0	959,543	15.8
Other Family	8	0.8	208	1.1	32,438	1.7	102,559	1.7
Employment Status of Parents	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Both employed (full-time work)	130	16.1	2,403	14.9	360,916	22.6	1,084,006	21.6
Both employed (part-time work)	31	3.8	670	4.2	63,106	4.0	203,596	4.1
One employed full-time, one part-time	170	21.0	3,142	19.5	329,567	20.6	1,086,460	21.7
One employed full-time, one not working	76	9.4	1,963	12.2	240,084	15.0	749,886	15.0
One employed part-time, one not working	62	7.7	1,004	6.2	96,933	6.1	302,037	6.0
Both not working	259	32.0	5,081	31.6	334,742	21.0	1,006,697	20.1
Other	31	3.8	774	4.8	80,905	5.1	264,145	5.3
Dwelling Structure	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Separate House	1,057	77.5	20,932	79.6	1,729,820	66.4	6,041,788	72.9
Semi-detached	173	12.7	361	13.7	317,453	12.2	1,055,016	12.7
Flat/Apartment	3	0.2	1,004	3.8	519,390	19.9	1,087,434	13.1
Other	111	8.1	621	2.4	23,580	0.9	64,425	0.8
Household Composition	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
Family Households	978	71.2	19,001	72.3	1,874,524	72.0	5,907,625	71.3
Single Person Households	356	25.9	6,637	25.3	620,778	23.8	2,023,542	24.4
Group Households	39	2.8	647	2.5	109,004	4.2	354,917	4.3



Number of Motor Vehicles/Dwelling	Anna Bay	%	Port Stephens	%	NSW	%	Aus	%
None	53	3.9	1,074	4.1	239,625	9.2	623,829	7.5
1 Vehicle	531	38.8	9,295	35.4	946,159	36.3	2,881,485	34.8
2 Vehicles	462	33.7	9,709	36.9	887,849	34.1	2,999,184	36.2
3 Vehicles	265	19.3	5,043	19.2	435,053	16.7	1,496,382	18.1
Not Stated	59	4.3	1,165	4.4	95,623	3.7	285,197	3.4

Appendix 2
**Appendix 2: Anna Bay Community Meeting 12 September, 2018 Public Notification and
Presentation Overview**

**Public Meeting
Proposed Anna Bay Sand Quarry
and Ancillary Caretaker's Residence/
Site Office
Lot 591 DP 1191380:
4226 Nelson Bay Road, Anna Bay**

A Public Meeting will be held at Anna Bay/Birubi Point Community Hall, 1a Fishermans Bay Road, Anna Bay, on Wednesday 12 September, 2018, commencing at 6:00pm.

Ragusa Pty Ltd is proposing to undertake a sand quarrying development and build an ancillary caretaker's residence/site office on land at 4226 Nelson Bay Road, Anna Bay.

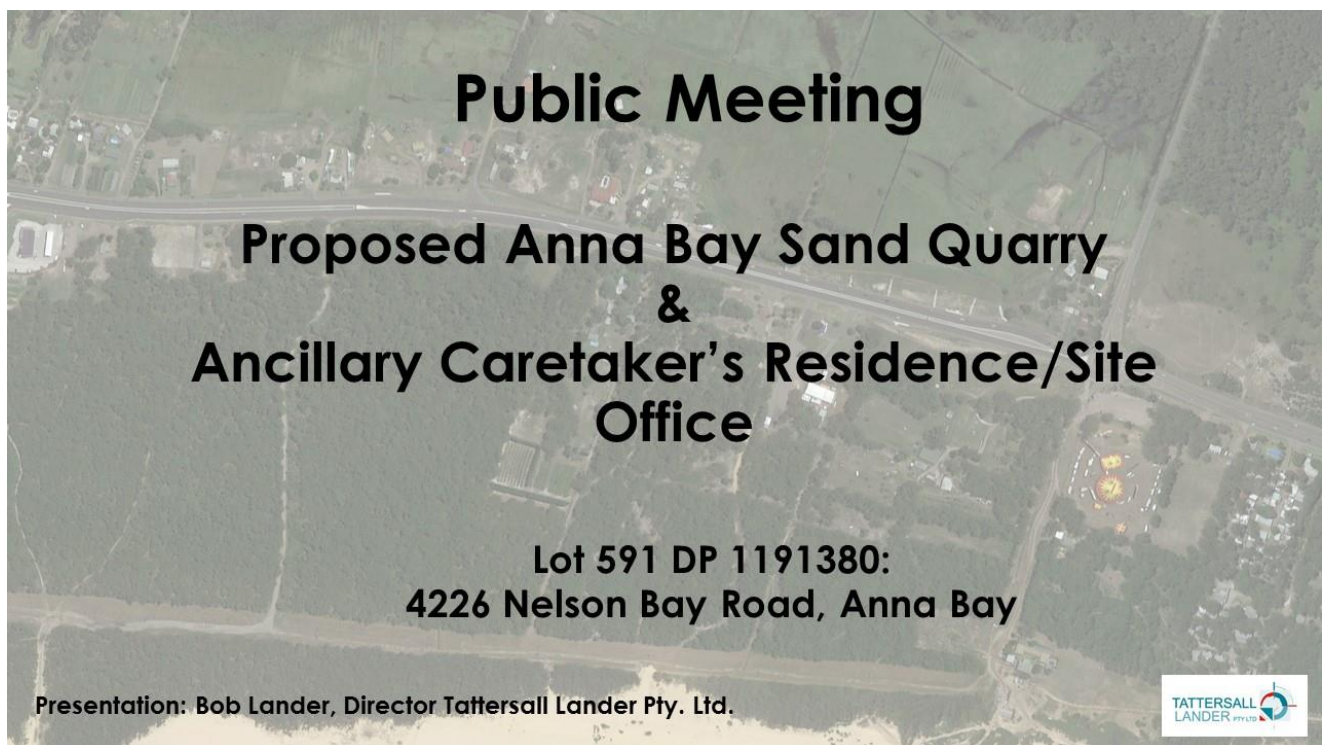
Tattersall Lander Pty Ltd acts for Ragusa Pty Ltd in the preparation of an Environmental Impact Statement (EIS) for the proposed development at the site.

The project proposes the establishment of a sand quarry with a yearly production rate maximum of 50,000 cubic metres per year.

The Public Meeting will be provided with a detailed briefing on proposed operational and planning details and the local community is invited to raise any relevant issues and questions.

**For further information, please contact
Bob Lander or Julie Wells on 4987 1500.**

AW3584561



Public Meeting

**Proposed Anna Bay Sand Quarry
&
Ancillary Caretaker's Residence/Site
Office**

**Lot 591 DP 1191380:
4226 Nelson Bay Road, Anna Bay**

Presentation: Bob Lander, Director Tattersall Lander Pty. Ltd.





Welcome



Meeting Purpose

1. To provide information about the proposed development and the associated planning process; and
2. To provide an opportunity for public input into finalisation of planning documents prior to lodgement with Council; and
3. To provide a community forum to ask questions about the proposed development



Role of Tattersall Lander Pty. Ltd.

Preparation of an Environmental Impact Statement (EIS)

Detail of EIS prescribed by Department of Planning & Environment

Lodgement of Development Application with Port Stephens
Council

Joint Regional Planning Panel is the determining authority

Ongoing Project Management



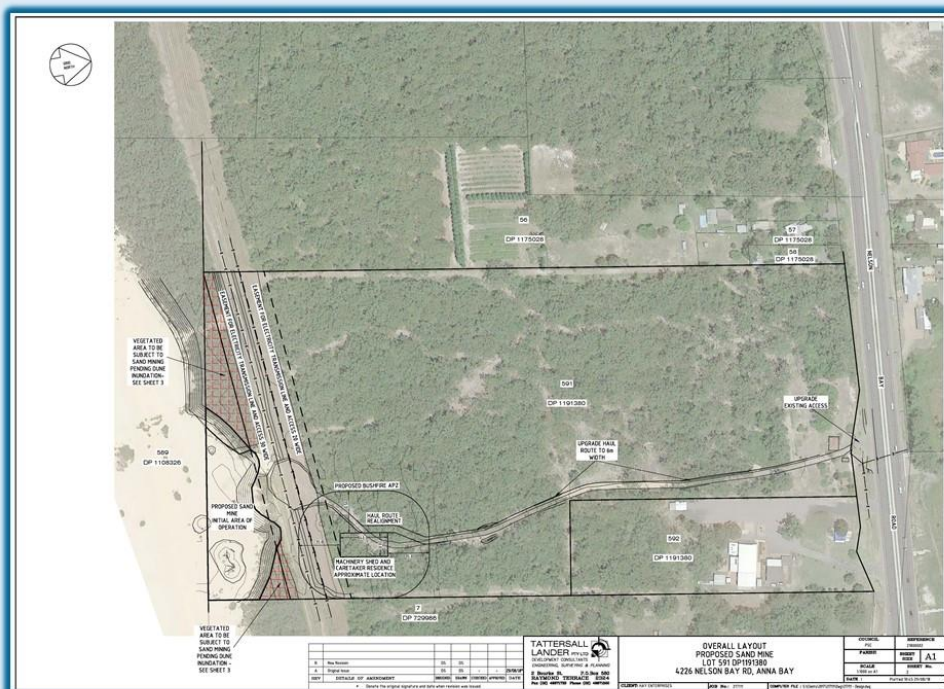


What is Proposed?

Extraction of a maximum of 50,000 cubic metres (76,460 metric tonnes) of sand per year for up to 30 years

Ancillary Caretaker's Residence and Site Office









Sand Deposition

Electricity Easement

Vegetation





Sand Deposition

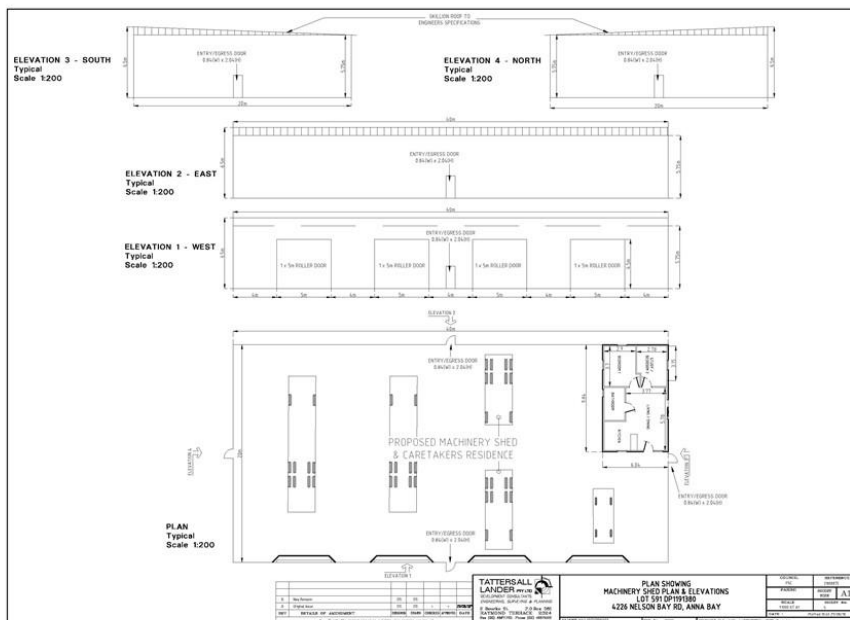
Vegetation



Sand Deposition

Vegetation





Proposed Caretaker's Residence & Site Office

EIS Considerations

The Department of Planning & Environment has prescribed examination of the following matters:

1. Noise Impacts
2. Air Quality Impacts
3. Ecological Impacts
4. Visual Impacts
5. Traffic Impacts
6. Social and Economic Impacts
7. Surface and Groundwater Impacts
8. Bushfire Considerations
9. Aboriginal Cultural Heritage Considerations
10. European Heritage Considerations
11. Waste Management Considerations

Where to from here?



Questions or Comments?



Appendix 3: Media Article

Another sand mine proposal

BY CHARLIE ELIAS

A NEW sand mine is being proposed for Anna Bay, seeking to extract 50,000 cubic metres a year over 30 years and expecting to add 40 truck movements a day along Nelson Bay Road.

Details of the mine were revealed by consultants Tattersall Lander for owner Regusa Pty Ltd for the first time at a public meeting held last Wednesday night.

Regusa has its address listed in Soldiers Point at the same premises of Dalcop, operator of the Soldiers Point Marina.

The proposal is for a sand quarrying development and caretaker's residence on land at 4226 Nelson Bay Road (behind the Baylife Church) at Anna Bay. There are three existing sand mines within close proximity of the new proposal.

Project manager Bob Lander told around 20 residents who attended the meeting at Birubi Community Hall on September 12 that the need to extract sand stemmed from a build up of sand over time which had



PUBLIC MEETING: Bob Lander addresses the gathering who turned out at the Birubi Community Hall to hear about another proposed sand mine for Anna Bay.

the potential to cause interference with Ausgrid's transition lines.

"In some areas the sand dunes are higher than the existing nine-metre high power cables," Mr Lander

told the gathering.

An Ausgrid spokesperson said that Ausgrid was not aware of the development application and was not in a position to make a comment because it "had not been ap-

proached regarding the EIS [environment impact statement]."

Mr Lander said it was proposed that the Bobs Farm-based civil works and demolition firm Hay Enter-

prises would provide the earthworks for the project.

Faced with questions over the impact on the underground water table, Mr Lander assured residents that sand would only be extracted

from above ground level.

He also responded to the concerns expressed by residents over the proposed increase in the number of truck movements along busy Nelson Bay Road and access to the site.

"There will be a maximum of 40 truck movements a day for five-and-a-half days a week, and a left-turn only lane will be added subject to the normal Roads and Maritime Services conditions," he said.

Mr Lander said that an environmental impact statement addressing noise, air quality, groundwater, ecology, visual, traffic, social, economic, bushfire, waste management and Aboriginal heritage was being prepared before lodgement with the Department of Planning could take place.

He said that the development application process was expected to take at least nine months and the final decision rested with the state-based Joint Regional Planning Panel (JRPP). Port Stephens Council would also be expected to comment on the merits of the proposal.